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Asia and the Pacific

Volume III

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Foreword

This edition of the U.S. Geological Survey (USGS) Minerals Yearbook discusses the performance of the worldwide minerals and materials industries during 2008 and provides background information to assist in interpreting that performance. Content of the individual Minerals Yearbook volumes follows:

- Volume I, Metals and Minerals, contains chapters about virtually all metallic and industrial mineral commodities important to the U.S. economy. Chapters on survey methods, summary statistics for domestic nonfuel minerals, and trends in mining and quarrying in the metals and industrial mineral industries in the United States are also included.
- Volume II, Area Reports: Domestic, contains a chapter on the mineral industry of each of the 50 States and Puerto Rico and the Administered Islands. This volume also has chapters on survey methods and summary statistics of domestic nonfuel minerals.
- Volume III, Area Reports: International, is published as four separate reports. These regional reports contain the latest available minerals data on more than 190 foreign countries and discuss the importance of minerals to the economies of these nations and the United States. Each report begins with an overview of the region's mineral industries during the year. It continues with individual country chapters that examine the mining, refining, processing, and use of minerals in each country of the region and how each country's mineral industry relates to U.S. industry. Most chapters include production tables and industry structure tables, information about Government policies and programs that affect the country's mineral industry, and an outlook section.

The USGS continually strives to improve the value of its publications to users. Constructive comments and suggestions by readers of the Minerals Yearbook are welcomed.

Marcia K. McNutt, Director

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Contacts

Information about the U.S. Geological Survey, its programs, staff, and products may be accessed on the Internet at http://www.usgs.gov or by contacting the Earth Science Information Center at 1-888-ASK-USGS. For specific information about this publication, contact the Chief, Global Minerals Analysis Section, National Minerals Information Center (NMIC), at (703) 648-7732, or the NMIC secretary at (703) 648-4961. Additional minerals information may be accessed on the Internet at http://minerals.usgs.gov/minerals.

Acknowledgments

The Country Specialists in the National Minerals Information Center, U.S. Geological Survey, in preparing the International Review regional books of volume III of the Minerals Yearbook, extensively use statistics and data on mineral production, consumption, and trade provided by various foreign Government minerals and statistical agencies through various official publications. The cooperation and assistance of these organizations are gratefully acknowledged. Statistical and informational material was also obtained from reports of the U.S. Department of State, United Nations publications, and the domestic and foreign technical and trade press. Of particular assistance were reports submitted by the Resource Reporting Officers and other officers of the Department of State in U.S. Embassies worldwide. Their contributions are sincerely appreciated. Internal statistical support was provided by the staff of the Data Collection and Coordination Section of the National Minerals Information Center.

The regimes of some countries reviewed in this volume may not be recognized by the U.S. Government. The information contained herein is technical and statistical in nature and is not to be construed as conflicting with or being contradictory of U.S. foreign policy.

John H. DeYoung, Jr.
Director, National Minerals Information Center

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THE MINERAL INDUSTRIES OF ASIA AND THE PACIFIC

By Yolanda Fong-Sam, Chin S. Kuo, Lin Shi, Pui-Kwan Tse, Susan Wacaster, and David R. Wilburn

The Asia and the Pacific region, which includes 31 countries and territories, has a total area of about 29.9 million square kilometers, which accounts for about 20.1% of the world total. The total population was about 3.71 billion, which accounted for about 55.5% of the world total in 2008. China and India, which were the world's two most populous countries, accounted for about 66% of the region's total population and about 37% of the world's total population. The economies of Bhutan, China, East Timor, India, Laos, and Mongolia were the fastest growing in the region in 2008 with real gross domestic product (GDP) growth rates of more than 7% (tables 1, 2).

Australia and China were among the world's leading mineral producers. Australia has large resources of bauxite, coal, cobalt, copper, diamond, gold, iron ore, lead, lithium, manganese, mineral sands, tantalum, and uranium. China has large resources of antimony, arsenic, barite, coal, fluorite, gold, graphite, iron ore, magnesium, rare earths, strontium, tin, tungsten, and zinc. India also was one of the world's significant mineral producers and has large resources of barite, bauxite, chromium, iron ore, manganese, rare earths, and salt. Other significant mineral producers in the region were Indonesia, which has large resources of coal, copper, gold, nickel, and tin; Mongolia, which has large resources of copper, fluorspar, and molybdenum; Papua New Guinea, which has large resources of copper and gold; the Philippines, which has large resources of copper, gold, and nickel; and Thailand, which has large resources of feldspar, gypsum, and potash (table 4).

Despite the large amount and wide variety of resources of nonfuel minerals and coal in Australia, China, India, Indonesia, Mongolia, Papua New Guinea, the Philippines, and Thailand, the regional supplies of numerous nonfuel minerals [including aluminum, bauxite, copper, diamond, gold, iron ore, lead, phosphate rock, platinum-group metals (PGM), silver, and zinc] and such major mineral fuels as coal, natural gas, crude petroleum, and refined petroleum products, were insufficient to satisfy the demand in the region in recent years. The shortage was caused largely by a substantial increase in the consumption of nonfuel minerals and mineral fuels by China and India; by continued high levels of consumption by such resource-poor industrialized countries as Japan, the Republic of Korea, Singapore, and Taiwan; and by the growing economies of such middle-income developing countries as Indonesia, Malaysia, and Thailand. In 2008, the region of Africa and the Middle East supplied a large percentage of the Asia and the Pacific region's requirements for natural gas, crude petroleum, and refined petroleum products. Africa, North America, and South America supplied a substantial percentage of the region's raw material requirements for ferrous and nonferrous metals.

China and Japan were the two major regional markets for crude and processed minerals. Japan was the region's leading consumer of imported ferrous and nonferrous metals because of its large manufacturing sector and poor indigenous resources. China, however, remained the region's leader in terms of growth in consumption, especially for such mineral commodities as aluminum, cement, coal, copper, iron and steel, lead, natural gas, crude petroleum, phosphate rock, rare earths, tin, and zinc. India, Indonesia, Malaysia, the Republic of Korea, Singapore, Taiwan, Thailand, and Vietnam also were important consumers of such mineral commodities as aluminum, cement, copper, gold, iron ore, lead, phosphate rock, silver, steel, and zinc.

Acknowledgments

The U.S. Geological Survey (USGS) acknowledges and thanks the following foreign Government agencies, international institutions, and private research organizations for providing mineral-production statistics, basic economic data, and exploration and mineral-related information:

For mineral production statistics—

- Australia—Australian Bureau of Agricultural and Resource Economics (ABARE) and Western Australia Department of Mines and Petroleum [since January 1, 2009];
- Bhutan—Ministry of Trade and Industry, Department of Geology and Mines;
- Brunei—Prime Minister's Department, Petroleum Unit;
- Cambodia—Ministry of Industry, Mines and Energy, Department of Mineral Resources Development;
- India—Indian Bureau of Mines;
- Japan—Ministry of Economy, Trade and Industry, Research and Statistics Department;
- Laos—Ministry of Industry and Handicraft, Department of Geology and Mines;
- Malaysia—Ministry of Natural Resources and Environment, Minerals and Geoscience Department;
- Mongolia—Mineral Resources and Petroleum Authority;
- Nepal—Ministry of Industry, Commerce and Supplies, Department of Mines and Geology;
- Republic of Korea—Korea Institute of Geoscience and Mineral Resources;
- Sri Lanka—Geological Survey and Mines Bureau;
- Thailand—Ministry of Industry, Department of Primary Industries and Mines; and
- Vietnam—Vietnam Institute of Geosciences and Mineral Resources.

For key economic data—

- Asian Development Bank in Manila, Philippines;
- International Monetary Fund in Washington, DC; and
- The World Bank in Washington, DC.

For exploration and other mineral-related information—

- Australian Bureau of Statistics in Canberra, Australia; and
- Metals Economics Group in Halifax, Nova Scotia, Canada.

General Economic Conditions

In 2008, economic growth in the Asia and the Pacific region was significant with an average GDP (based on purchasing power parity) growth of 8.1%. Increased domestic consumption led to strong growth in such countries as East Timor (12.8%), China (9%), Mongolia (8.9%), Bhutan (7.6%), India (7.3%), and Laos (7.2%). Exports remained an important driving force of economic activity in such countries as Australia, China, Japan, the Republic of Korea, Singapore, and Taiwan. In the fall of 2008, foreign investment in the region collapsed. The financial sectors of Asia's developing economies appeared to be weathering the crisis quite well; however, the effects of the crisis were nonetheless being felt in the region and the economic growth was expected to be slower in the next 2 years compared with that of 2008. This slowdown could affect economic growth in such exporting countries as Japan, the Republic of Korea, Singapore, and Taiwan. Domestic consumption in such countries as China, India, and Vietnam was expected to continue to sustain growth as the value of exports continued to decline. Economic growth in the Asia and the Pacific region overall was expected to remain strong because of the improved macroeconomic policies that were put in place during the past several years; this improvement was evidenced by declining debt burdens and increases in the current account balances, fiscal balances, and foreign reserves (World Bank, The, 2010, p. 117, 150).

After the first quarter of 2008, economic growth was slow but steady in most of the developed countries in the West. In the Asia and the Pacific region, the manufacturing capacity was being transferred slowly from the developed countries to the developing countries, although the rate of growth in the demand for metals and minerals was expected to be less than that of the past 2 years. Many developing and most developed economies began to implement large-scale fiscal and financial stimulus plans to support domestic demand and counter the decrease in exports. China still led the global recovery by increasing industrial production and exports. The economic growth in China, Indonesia, and Vietnam was expected to be strong at 8.4%, 4.5%, and 5.5%, respectively, in 2009. Output contractions were expected to take place in Cambodia, Malaysia, and Thailand, which were expected to have economic growth of only 2.2%, 2.3%, and 2.7%, respectively (World Bank, The, 2010, p. 26-30).

Legislation

Revisions to section 124 of Australia's Land Acquisition Act 1989 that were sent to the Parliament in 2008 would, under Commonwealth mining regulations, allow States and Territories to administer, explore, and mine on Commonwealth land under a consistent regulatory scheme (Parliament of Australia, 2008). Primary Industries and Resources South Australia announced a new schedule of fees under the Mining Act 1971; these fees went into effect on July 1, 2008. The application fee to register a mineral claim increased to $269 from $27.50, and the mining lease application fee increased to $897 from $73 (Australian Mining, 2008a). The government of Western Australia approved the Royalties for Regions program, which would reinvest about 25% of the State's annual mining and resources royalty revenues in regional communities starting in 2009 (Australian Mining, 2008b). The Northern Territory government would allocate $2.15 million during the course of the next 3 years (beginning in 2009) to increase the pace of exploration drilling and geophysics in undeveloped areas of the State by providing funding assistance to successful applicant projects. Seven drilling projects were approved under this program in 2008 (Northern Territory Government, 2009).

In China, the "2008-2015 National Plan for Mineral Resources" was released in late 2008 (Trading Markets, 2008). The plan, formulated by the Ministry of Land and Resources, proposes enhancing regulation on exploration and use of mineral resources, specifies areas to be encouraged or restricted, and discusses the establishment of strategic reserves for selected mineral resources. The Government also passed provisions for licensing of geologists and prospectors in China (Kosich, 2008c).

The Indian Ministry of Mines continued the process of securing support for its revised National Mineral Policy. The revised legislation, which was enacted into law in the 2009 session of the Indian Parliament, is designed to stimulate investment in the Indian mining sector and simplify the regulatory framework. Annually, foreign direct investment in the Indian mining sector for the period 2000-08 averaged $510 million (Campbell, 2008).

After 3 years of discussion, the Indonesian Government passed a new mining law that gives local governments greater control over exploration and mining activities, limits exploration areas to 100,000 hectares, reduces the length of time that miners have to extract resources from a maximum of 70 years to 20 years, requires separate permits for each phase of mining activity, and requires local processing of mined materials (Karmini, 2008). Indonesia also announced plans to allow exploration and mining companies that previously held exploration permits in forested areas to resume exploration activity after paying specified fees (Reuters, 2008).

The year 2008 marked a period of transition for the fledgling Mongolian mining industry. The World Bank allocated $9.3 million from International Development Association funds for a mining sector technical assistance project aimed at improving Mongolia's ability to manage and regulate the mining sector effectively (Kosich, 2008d). The Mongolian Parliament included the new position of Minister of Mining and Energy in its new coalition government to oversee energy and mining activities in Mongolia (Kosich, 2008a). The new government has reportedly drafted amendments to its 2006 minerals law that are designed to ease the tax burden of foreign companies and annul the windfall profits tax to bring mining royalties in line with international standards (Kosich, 2008b).

In Vietnam, the Prime Minister approved a master plan for basic geologic investigation of mineral resources to the year 2015, with orientation to the year 2020. The Prime Minister also approved a zoning master plan for the exploration, mining, processing, and use of bauxite in the period 2007-15, with vision to 2025 taken into consideration.

Exploration

Investment in exploration activity in much of the Asia and the Pacific region increased in 2008 from the 2007 levels of investment. Exploration data derived from the Metals Economics Group (MEG) suggest that the 2008 proposed budget allocations for Australian exploration activity increased by 49% to $1.76 billion from $1.18 billion in 2007. Similarly, the 2008 budget for the Pacific region (excluding Australia) increased by about 47% to $630 million from $430 million in 2007 (Metals Economics Group, 2008).

Australia's total nonfuel mineral exploration spending, excluding coal, petroleum, and uranium, was reported to be $1.7 billion for fiscal year 2007-08, which was an overall increase of about 42% from the $1.2 billion reported for fiscal year 2006-07 (Australian Bureau of Statistics, 2009). Although the estimated expenditures for gold exploration accounted for 30% of the total Australian expenditure for nonfuel metals and minerals, gold exploration, in nominal terms, increased by about 31% in fiscal year 2007-08 to $510 million from $390 million in fiscal year 2006-07. In contrast, the estimated expenditure for copper exploration increased by 25% to $250 million in fiscal year 2007-08; the exploration expenditures for iron ore increased by 58% to $380 million, and those for silver, lead, and zinc increased by 34% to $160 million. Western Australia's share of the Australian mineral exploration expenditure accounted for 51%; that of Queensland accounted for about 16%; South Australia, about 14%; New South Wales, 8%; Northern Territory, 6%; Victoria, 4%; and Tasmania, 1% (Australian Bureau of Statistics, 2009).

Over the past 30 years, gold projects accounted for 60% to 80% of mineral exploration spending in Australia and an average of 65% in Western Australia. By fiscal year 2007-08, however, gold project expenditures accounted for about 30% of all metals-related mineral exploration activity in Australia and 28% in Western Australia. The allocation for iron ore, on the other hand, increased from about 7% in fiscal year 2000-01 to about 23% in fiscal year 2007-08 in Australia and 33% in Western Australia. In fiscal year 2007-08, nickel and copper exploration each accounted for about 15% of Australian exploration, and exploration for silver, lead, and zinc accounted for about 9% (Australian Bureau of Agricultural and Resource Economics, 2008a).

Of the 183 nonfuel mineral exploration projects considered by ABARE between April 2008 and October 2008, 140 projects (77%) were listed as being in the preconstruction stage of development. Of these projects, 34 projects were for gold and iron ore; 20 were for nickel; 13 each were for copper and other commodities; 12 were for lead-zinc-silver; and 8 were for mineral sands. About 51% of these projects were located in Western Australia; 16%, in Queensland; 12%, in New South Wales; 11%, in South Australia; 5%, in Northern Territory; 4%, in Victoria; and 1%, in Tasmania. Australian States and Territories that experienced the highest levels of exploration activity in 2008 were, in descending order based on the number of sites compiled for this annual review, Western Australia (55%), Queensland (12%), South Australia (9%), New South Wales (8%), Northern Territory (9%), Tasmania (5%), and Victoria (2%) (Australian Bureau of Agricultural and Resource Economics, 2008b).

Mineral exploration in China had increased since the country opened its mining sector to foreign investment during the 1990s and was driven by the rapid growth of Chinese minerals consumption. China maintained its spending of 3% of the world's total exploration budget in 2008 (Metals Economics Group, 2008). More than 100 foreign companies had invested in mineral exploration in China and launched more than 400 projects (People's Daily Online, 2007). China was reported to have invested up to $8.9 billion in geologic exploration in 2007, which was a 25% increase compared with exploration investment in 2006 (Interfax News Service Ltd., 2008). These investment figures are believed to include spending in exploration activities for minerals, crude oil, and natural gas.

Indonesia, Papua New Guinea, and the Philippines each reported an exploration budget of more than $100 million (Metals Economics Group, 2008). The increase in exploration in the Pacific region can be attributed to continued interest by Chinese companies to expand sources of mineral supply for gold and base metals and by Japanese companies to develop regional copper and nickel deposits to supply Japan's smelting industry (Takemoto, 2008). In 2008, interest in exploring in Southeast Asia increased. Gold exploration accounted for approximately 52% of all reported exploration activity in the Pacific region in 2008; copper, 22%; and nickel, 17%.

Commodity Overview

Estimates for the production of major mineral commodities for 2011 and beyond have been based upon supply-side assumptions, such as announced plans for increased production/new capacity construction and bankable feasibility studies. The outlook tables in this summary chapter show historic and projected production trends; therefore, no indication is made about whether the data are estimated or reported, and revisions are not identified. Data on individual mineral commodities in tables in the individual country chapters are labeled to indicate estimates and revisions. The outlook segments of the mineral commodity tables are based on projected trends that could affect current (first quarter of 2009) producing facilities and on planned new facilities that operating companies, consortia, or Governments have projected to come online within indicated timeframes. Forward-looking information, which includes the cost of capital projects, estimates of future production, exploration and mine development, and timing of the start of operations, are subject to a variety of risks and uncertainties that could cause actual events or results to differ significantly from expected outcomes. Projects listed in the following section are presented as an indication of industry plans and are not a USGS prediction of what will take place.

Metals

Aluminum and Bauxite and Alumina.—The region's production of bauxite accounted for about 57% of the world total in 2008. Australia, which was the world's leading producer of bauxite, accounted for about 30% of the world total; it was followed by China, 16%, and India, 10%. Production of aluminum accounted for about 44% of the world total in 2008. China, which was the world's leading producer of aluminum, accounted for about 33.5% of the world total; it was followed by Australia, 4.4%; India, 2.8%; and Japan, 2.4% (table 4).

Regional production of bauxite and aluminum was expected to continue to increase at an average annual rate of about 4.1% and 3.8%, respectively, between 2008 and 2015 (tables 5, 6). This prediction was based on reported capacity expansions and new projects in Australia, China, India, and Vietnam.

In Australia, Alcan Inc. of Canada expanded its Gove alumina refinery in Northern Territory to 3.8 million metric tons per year (Mt/yr) from 2.0 Mt/yr, and the refinery was expected to be fully operational by the end of 2008. Rio Tinto Alcan's Weipa Mine in Queensland planned to expand its capacity to 21.0 Mt/yr in 2013 from 18.2 Mt/yr in 2008. Aluminum Corporation of China Ltd. (Chalco) planned to develop the Aurukun bauxite deposit at Aurukun in Queensland and to mine bauxite in 2011 with a production capacity of between 2 and 3 Mt/yr. In India, Dubai Aluminium Co. and Larsen and Toubro Ltd. of India planned to build a bauxite mine in Orissa in 2009. The initial design was to mine 10 Mt/yr of bauxite ore and to produce 6.5 Mt/yr of beneficiated ore. The project was contingent upon building an alumina refinery. The Utkal alumina project included the development of a new bauxite mine to feed the 1.5-Mt/yr refinery in Orissa. Nalco was expected to increase its bauxite output to 6.3 Mt/yr from 4.8 Mt/yr in 2009. In Indonesia, P.T. Antam Tbk planned to increase bauxite production by 850,000 metric tons per year (t/yr) to feed the new alumina refinery at Tayan in 2010. In Vietnam, Vietnam Mineral Corp. (a joint venture between Vietnam National Coal-Mineral Industries Group and Chalco) planned to construct a $1.6 billion bauxite mine and an alumina refinery in Central Highlands, Lam Dong Province.

China became a net importer of bauxite (mainly from Indonesia) and alumina (from Australia) for the first time in 2008. The country's alumina output capacity reached 26 Mt/yr. Alumina refineries in Shandong Province relied on imported bauxite to meet their demand. By 2010, China was expected to become the leading bauxite importer in the world, and its alumina output was expected to be sufficient to meet domestic demand for aluminum production. The country had 11 aluminum smelters under construction with a combined capacity of 1.12 Mt/yr and 10 aluminum projects in feasibility study with a total capacity of 1.4 Mt/yr. In India, Vedanta Resources plc planned to build a 500,000-t/yr aluminum smelter in Orissa in 2010 and to expand it to 2.6 Mt/yr in 2012. JSW Group planned to build a 250,000-t/yr aluminum smelter at Visakhapatnam in the State of Andhra Pradesh. Hindalco Industries and National Aluminium expanded their smelting capacities by 140,000 t/yr and 110,000 t/yr, respectively. Owing to the economic downturn, some of the new or expansion projects might not be on track. In Malaysia, Rio Tinto Alcan and CMS's Sarawak AC Co. planned to start construction of their 1.5-Mt/yr smelter in 2011. Production of aluminum was expected after 2015.

In 2008, refined aluminum consumption in the Asia and the Pacific region accounted for about 52% of the world total compared with 50% of the total in 2007. The increase in aluminum consumption in the region was mainly owing to increased consumption by China [15.3 million metric tons (Mt)] and India (1.3 Mt). In the near future, strong growth in Chinese and Indian consumption is expected to be offset by falling consumption in Japan (from the current 4.1 Mt) and the Republic of Korea [from 964,000 metric tons (t)]. In 2010, China is expected to account for more than one-third of the world's aluminum consumption, India will likely increase its level of consumption to about 7% of the world total (from about 3.5% in 2008), and Japan will likely continue to account for about 6%. China, India, and Japan are projected to account for more than 45% of the world's total aluminum consumption during the next 5 years.

Copper.—The region's production of mined copper accounted for about 19% of the world total in 2008. China was the leading regional producer followed by Australia and Indonesia. Production of primary refined copper accounted for about 40% of the world's total output in 2008. Among the region's refined copper producers, China was the world's second ranked producer of primary and secondary refined copper behind Chile, and Japan was ranked third. Australia, India, and the Republic of Korea were also important producers of refined copper in the region (table 4).

Between 2008 and 2015, regional production of mined copper and refined copper was expected to continue to increase at an average annual rate of about 5.3% and 1.8%, respectively. This prediction was based on reported capacity expansions of mined copper in Australia, China, India, Indonesia, Laos, and Mongolia, and on reported capacity expansions of refined copper in Australia and China (tables 7, 8).

In Australia, BHP Billiton was considering an expansion of its Olympic Dam Mine to 500,000 t/yr from 235,000 t/yr, and OZ Mineral's Prominent Hill copper and gold project was expected to begin production in 2009 with 85,000 t/yr of contained copper. Small copper projects from 15,000 t/yr to 25,000 t/yr in New South Wales, Queensland, and South Australia were expected to be brought onstream during the next 3 years. In China, the Yulong copper mine in Xizang Autonomous Region was expected to be brought onstream in 2009 with production of 10,000 t/yr of copper. The Pulang copper mine in Yunnan Province was under development in 2008 and would begin production in the next 2 to 3 years. In India, Pebble Creek Resources Ltd. planned to build a 210,000-t/yr (ore) underground copper mine at Pithoragarh, State of Uttaranchal. Hindustan Copper Ltd. planned to expand the output capacities of its active mines to a total of 7.9 Mt/yr in 2013 and to reopen the Surda Mine, which would have an output capacity of 4,500 t/yr of copper concentrate. In Indonesia, gradual capacity expansion was to be undertaken by P.T. Newmont Nusa Tenggara at Batu Hijau on Sunbawa Island, Province of West Nusa Tenggara. P.T. Freeport Indonesia Co. at Grasberg, Province of Papua, deferred mining high-grade ore to later years owing to low copper prices. In Laos, the first-phase development of the Phu Kham copper-gold project was scheduled to be completed in 2008 with production of 60,000 t/yr of copper. In Mongolia, the Oyu Tolgoi project was expected to start production of 450,000 t/yr of copper in concentrate by 2013. In Papua New Guinea, the Ok Tedi Mine's expected life was projected to 2013 because of declining production. New copper projects by Marengo Mining Ltd. and Nautilus Minerals Inc. were expected to be commissioned in 2014 or later.

Production of refined copper in Australia was expected to remain at about 480,000 t/yr during 2011-15, even though a 20,000-t/yr expansion project by the Townsville copper refinery and the 15,000-t/yr Lady Annie greenfield project were underway. In China, Jiangxi Copper Co. Ltd. planned to increase its refining capacity of copper to 900,000 t/yr in 2010 from 700,000 t/yr in 2008 at Guixi, Province of Jiangxi, and to build a 200,000-t/yr secondary refined copper plant in Guangdong Province in 2008. Yunnan Copper Group Co. Ltd. planned to increase its refinery capacity to 600,000 t/yr in 2010 from 300,000 t/yr in 2008 at Kunming, Province of Yunnan. Tongling Nonferrous Metal Group planned to expand its total refined copper output capacity by 20% to 800,000 t/yr in 2010. In Indonesia, P.T. Smelting planned to increase production of refined copper to 300,000 t/yr in 2009 from 210,000 t/yr in 2008, and P.T. Indosmelt planned to build a 100,000-t/yr-capacity smelter in 2013. In the Philippines, Philippine Association Smelting and Refining Corp. was expected to expand its refining capacity to 215,000 t/yr from 172,000 t/yr in the near future.

In 2008, unwrought refined copper consumption in the Asia and the Pacific region accounted for 51.7% of the world total compared with 50.3% of the total in 2007. The increase in copper consumption in the region was the result of increased copper consumption in China (5.5 Mt) and India (528,000 t). Japan and the Republic of Korea consumed 1.2 Mt and 804,000 t of unwrought copper, respectively. In the future, the power sector, which accounted for about 50% of China's copper consumption in 2008, was expected to increase its consumption by 5% per year to reach a total of about 3 Mt in 2013. In 2010, the region could account for more than 50% of the world's total copper consumption, and China, for about 30%; Japan, about 7%; the Republic of Korea, 5%; and India, about 3%. Except for Australia, Japan, New Zealand, the Republic of Korea, Singapore, and Taiwan, countries of the Asia and the Pacific region were well below the per capita copper consumption of developed countries. Copper consumption in the Asia and the Pacific region, especially in China and India, was expected to increase significantly in the next 5 years owing to gradual economic growth in these countries.

Gold.—The region's production of mined gold accounted for about 22% of the world total in 2008 (table 4). China was the leading gold producing country in the region followed by Australia, Indonesia, and Papua New Guinea (table 9). China was ranked first (overtaking South Africa) in the world production of gold.

Regional production of mined gold was expected to continue to increase at an average annual rate of 3.9% between 2008 and 2015. This prediction was based on gradual capacity expansions mainly at the major copper and gold mines in Australia, China, Indonesia, Mongolia, and Papua New Guinea (table 9).

Australian gold production was expected to increase steadily in the next few years. The Bendigo Mine in Victoria, the Fortnum Mine in Western Australia, the Gully and the Union Reef Mines in Northern Territory, and the Warrior Mine in Queensland were all expected to be brought onstream during the next 2 years. Monarch Resources' Davyhurst gold project, which would have a production capacity of 3 t/yr, and Mercator's Meekatharra gold operation, which would have a capacity of 3.7 t/yr, were expected to come onstream in 2009. In China, the CSH Mine in the Nei Mongol Autonomous Region and the Lannigou Mine in Guizhou Province were expected to start production at the end of 2008. Jinshan Mines' Dadiangou Mine in Gansu Province was expected to be put into operation by 2010. Gold production in Indonesia was expected to increase because of access to exceptionally high-grade ore from Freeport Indonesia's Grasberg Mine, and output was expected to remain steady during the next several years. The increase of gold production in Mongolia depends upon when the Oyu Tolgoi copper-gold mine would be put into operation, most likely in 2013. Laos increased its mined gold production at the Sepon gold mine (operated by OZ Minerals Ltd.) and at the Phu Bia heap-leach gold mine (operated by Pan Australian Resources Ltd.). In Papua New Guinea, Lihir Gold Ltd. was expected to produce 26,500 kilograms (kg) of gold in 2009 and planned to expand gradually to 31,100 kg of gold in later years.

During the past decade, foreign investors introduced modern technology to China that accelerated gold exploration and mine production, and the Chinese Government provided incentives for foreign companies to invest in China's western region. Gold production in China increased at both large- and small-scale mines throughout the country in 2008. Gold production in South Africa continued to decrease during the past 4 years, and China was expected to replace South Africa as the leading gold producing country in the world in the next 2 years.

The region was the world's major market for gold and accounted for about 45% of the world's total gold consumption in 2008. India was the world's leading consumer of gold, accounting for about 27% of the world total. Owing to continuing strong economic growth and rising urban incomes (which lead to higher demand for gold jewelry), China replaced the United States as the second ranked gold consumer in the world. Jewelry accounted for about 90% of the world's gold consumption and about 92% of Chinese consumption. In the next 2 to 3 years, China could overtake India in gold consumption. The Chinese Government indicated that the country had increased its gold holdings. Gold demand in other countries in the region was expected to remain steady.

Iron and Steel.—The region's production of iron ore was estimated to account for, in terms of gross weight, about 63% of the world total in 2008. China ranked second in the world in the production of iron ore (in terms of iron content) after Brazil; it was followed by Australia and India. The region's production of crude steel was estimated to account for about 58% of the world total. China, which was by far the world's leading producer of crude steel, accounted for about 37.6% of the world total, and Japan, India, and the Republic of Korea ranked second, fifth, and sixth, respectively, in the world (table 4).

East Asian countries, such as China, Japan, and the Republic of Korea, were the world's leading consumers and importers of iron ore. Australia was the region's and the world's leading exporter of iron ore. India's iron ore output increased sharply to meet domestic and regional demand. India, which was China's third ranked iron ore supplier after Australia and Brazil, was expected to remain in that position for the next several years. Brazil and South Africa also would continue to be major iron ore suppliers to the region. Imports of iron ore by East Asian countries were expected to continue to increase, especially imports by China to meet its steel industry's demand.

Regional production of iron ore was expected to increase at an average annual rate of about 4.3% between 2008 and 2015. This prediction was based on gradual capacity expansions in Australia, China, and India. In Australia, capacity expansion to 52 Mt/yr was completed at Rio Tinto plc's Yandicoogina Mine in 2008. Rio Tinto also planned to develop a 22-Mt/yr iron ore mine at Hope Downs in Western Australia by 2008. The Board of Rio Tinto approved a company investment of $2.4 billion in two new iron ore mines—the Bobe Valley/Brockman 4 and the Mess/Warramboo—in Pilbara, Western Australia. The two mines were scheduled to begin operation in 2011 and 2012, respectively, with a total combined output capacity of 47 Mt/yr. BHP Billiton planned to expand capacity at its Newman Mine to 63 Mt/yr in 2010. In China, several iron mines were under construction or were in the planning stage, including the Cangshaw Mine (2 Mt/yr) in Shandong Province, the Longtongyan Mines (1.3 Mt/yr) in Anhui Province, and the Takong Mine (1.2 Mt/yr) in Jilin Province. In North Korea, China Minmetal Corp. and Tonghua Iron and Steel Corp. planned to redevelop the Musan Mine to increase its iron ore production capacity to 10 Mt/yr in 2010 (table 10).

Regional production of crude steel was expected to increase at an average annual rate of about 4.3% between 2008 and 2015. China was expected to lead in crude steel expansion in the region. Shoudu Iron and Steel Group Co. and Tangshan Iron and Steel Group planned to build a 10-Mt/yr greenfield steel plant in Hebei Province in 2012. Anben Iron and Steel Group planned to expand its steel capacity in Liaoning Province to 30 Mt/yr from 22 Mt/yr by 2010. Tonghua Iron and Steel Group Co. Ltd. planned to expand capacity in Jilin Province to 10 Mt/yr during the next 3 years. The Chinese Government approved the applications of Baoshan Iron and Steel Group and Wuhan Iron and Steel Group to build two 10-Mt/yr greenfield steel plants in the Provinces of Guangdong and Guangxi, respectively; the plants were scheduled for production in 2013.

India also was expected to expand its crude steel capacity significantly. The expansion would include the construction of a 13-Mt/yr steel plant at Paradip, State of Orissa, as proposed by the government of Orissa and Pohang Iron and Steel Co. Ltd. of the Republic of Korea; the plant was expected to start producing steel in 2009. India's capacity expansion would also include two projects by JSW Steel Co. Ltd. at Vijayanagar, State of Karnataka, which were expected to increase the company's production capacity to 7 Mt/yr in 2008 and to 10 Mt/yr in 2011. JSW also planned to build a 10-Mt/yr steel plant at Saraikela Kharswan in Jharkhand in 2012, and the startup of its 10-Mt/yr steel plant in West Bengal was scheduled for 2009. Tata Steel planned to expand its Jamshedpur steel plant's capacity to 31 Mt/yr. ArcelorMittal and the State of Jharkhand planned to build a 13-Mt/yr steel plant in the State. In Vietnam, Thai Nguyen Iron and Steel Co. planned to increase its steel capacity to 1.3 Mt/yr by 2010 (table 11).

The volume of iron ore imports by China was expected to continue to increase. The country's iron ore imports could account for about 60% of its consumption by 2011. Imports of iron ore by Japan, the Republic of Korea, and Taiwan were expected to increase slightly during the next several years. Australia will continue to be a leading iron ore supplying country in the region. Owing to increased domestic demand, iron ore exports from India were expected to remain at the current level for the near future.

In 2008, the region consumed 693.8 Mt of finished steel products, or 57.9% of the world total. China was the world's leading consumer at 425.7 Mt. Japan was the world's leading exporter and the region's major supplier of steel products to China and to such major consumers in the region as the Republic of Korea (which consumed 58.6 Mt), Taiwan (16.7 Mt), Singapore, and Thailand. Japan itself consumed 76.4 Mt in manufacturing production. Steel consumption in India was 52.6 Mt and was expected to increase more significantly than in other countries in Asia, besides China, because of strong growth in industrial production and increased investment in the country's infrastructure. Owing to the low steel consumption in the region (54.5 Mt), the Association of Southeast Asian Nations (ASEAN) countries continued to remain small steel producers. Australia and New Zealand consumed small amounts of steel products for a total of 9.2 Mt.

Nickel.—The region's production of mined nickel, in terms of metal content, accounted for about 25% of the world total in 2008. Indonesia was the world's third ranked producer of mined nickel after Russia and Canada in 2008. Australia and New Caledonia, which were the region's other major producers of mined nickel, accounted for 7.4% and 4.1% of the world total, respectively (table 4).

Regional production of mined nickel was expected to continue to increase at an average annual rate of more than 5.4% between 2008 and 2015. This prediction was based on reported gradual expansions of capacity and increases in productivity (table 12). In Australia, Allegiance Mining NL's Avebury Mine in Tasmania was scheduled to be put into operation in 2008, and it would have an output capacity of 8,500 t/yr for 10 years. BHP Billiton's Ravensthorpe Mine was scheduled to begin operation in 2009 and to produce up to 50,000 t/yr of nickel. Additional expansion at the Yabulu refinery in Townsville to 180,000 t/yr was scheduled to be completed in 2010. In China, gradual capacity expansions were to be undertaken at mines in the Xinjiang Autonomous Region during the period 2008-13. A nickel mine in Yuanjiang County, Province of Yunnan, was to be developed, and a 10,000-t/yr nickel refinery was to be built near the mine site by 2009. Jilin Jien Nickel Co. planned to expand its mine output capacity to 600 metric tons per day (t/d) from 300 t/d by 2010. In Indonesia, Rio Tinto's new nickel mine on Sulawesi Island was expected to produce 46,000 t/yr of contained nickel by 2015.

In New Caledonia, Société Minière du Sud Pacifique (SMSP) planned to develop a new nickel mine to supply nickel concentrates to the new joint-venture nickel processing plant between SMSP and Pohang Iron and Steel Co. Ltd. in 2008. Vale Inco Ltd. restarted the construction of its Goro nickel mine, which was scheduled to be completed in 2012 and would have the capacity to produce 20,000 t/yr of nickel. The Goro Mine would have the capacity to produce about 60,000 t/yr of nickel and 5,000 t/yr of cobalt in 2014. Xstrata-SMSP's Koniambo nickel project was expected to start up in 2012 and to produce 60,000 t/yr of nickel in ferronickel in 2013. In Papua New Guinea, Highlands Pacific Ltd.'s Ramu nickel-cobalt project planned to produce 31,150 t/yr of nickel and 3,300 t/yr of cobalt in 2010. In the Philippines, Synutomo Metal Mining would add a second nickel plant to increase its output capacity to 20,000 t/yr from 10,000 t/yr in 2009.

In 2008, the region's consumption of refined nickel accounted for 51.3% of the world total compared with 52% in 2007. Stainless steel production accounted for about 65% of total world nickel consumption, and the demand for nickel was linked to the consumption of stainless steel. China was the leading stainless steel producing and importing country, and Japan, the Republic of Korea, and Taiwan supplied about 90% of China's total imports. Nickel consumption in China was expected to increase substantially accordingly, to about 25% of the world total, and that in such other countries as Japan, the Republic of Korea, and Taiwan was expected to decline in the future and would likely offset the increasing demand in China. Overall, the region would consume less refined nickel in the near future.

Platinum-Group Metals.—The region's production of mined platinum and palladium was insignificant and accounted for only 0.3% and 0.6%, respectively, of the world total in 2008. Between 2008 and 2015, regional production of mined platinum and palladium was expected to increase slightly at an average annual rate of about 2.9% and 2.3%, respectively. Jinchuan Nonferrous Metals of China produced platinum and palladium as byproducts of mined nickel from its nickel mining and refining operations at Jinchuan, Province of Gansu. Australia was not a primary producer of PGM, although small amounts of palladium were produced as a byproduct of nickel operations at Kalgoorlie-Boulder and Kambalda in Western Australia. Regional PGM consumption was expected to increase in the autocatalysts and electronics sectors. The rapid growth in the manufacture of automobiles, light vehicles, computers, and electronic goods in China and India increased the demand for PGM in the region (tables 13, 14).

Tin.—The Asia and the Pacific region was the dominant producer of mined tin and tin metal in the world. Production of mined tin and refined tin accounted for 67% and 79%, respectively, of the world total in 2008. China ranked first in the world in the production of mined tin and refined tin and Indonesia ranked second. The combined output of China and Indonesia accounted for about 64% of the world mined tin output. Other important refined tin producers in the region were Malaysia and Thailand (table 4).

Regional production of mined tin and refined tin was expected to continue to increase at an average annual rate of 5.2% and 2.2%, respectively, between 2008 and 2015. This prediction was based on reported gradual expansions of capacity and increases in productivity (tables 15, 16). In Australia, Metal X Ltd. planned to reopen its Mt. Bischoff and Renison Mines in Tasmania in 2008, and North Queensland Metals Ltd. planned to develop its Baal Gammon polymetallic mine in Queensland in later years. In Indonesia,Yunnan Tin Ltd. of China planned to develop a tin mine and construct a tin smelter on Bangka Island in Bangka-Belitung Province. P.T. Tambang Timah Tbk planned to increase offshore mining of tin as onshore ores were depleted. Because the Thai Government agreed to lower the tin royalty rate to 6%, Sea Minerals Ltd. of Thailand planned to increase its mined tin output during the next several years.

In 2008, China, which was the world's leading consumer of tin metal, accounted for about 37% of the world total followed by Japan, with 9.4%. The region consumed about 63% of the world's total consumption of tin metal, which was the same as in 2007. China's tin smelting capacity exceeded its mine output capacity; therefore, the country was required to import tin concentrates from such countries as, in order of volume (tonnage) of imports, Indonesia, Burma, Bolivia, Vietnam, and Laos in 2008. China became a net tin importing country in 2007. The Government cancelled the value-added-tax rebate and levied a 10% export duty on refined tin. The export volume of tin from China was expected to decrease in the future, and the Indonesian Government also restricted mined tin production and controlled refined tin output. As a result, the volume of tin supply on the world market also decreased. Indonesia replaced China as the leading tin exporting country in the region.

Zinc.—The region's production of mined zinc accounted for about 47% of the world total in 2008. China ranked as the world's leading producer of mined zinc and accounted for about 28.3% of the world total in 2008; it was followed by Australia, which accounted for about 13%. China was also the world's leading producer of zinc metal, and Australia, India, Japan, and the Republic of Korea were the region's other important producers (table 4).

Regional production of mined zinc was expected to increase slightly at an average annual rate of about 0.4% between 2008 and 2015. This prediction was based on reported gradual capacity expansions in China and India (table 17). Regional production of refined zinc metal was expected to increase at an average annual rate of about 1.5% between 2008 and 2015. This prediction was based on gradual capacity expansions mainly in Australia and China (table 18).

In Australia, gradual capacity expansions were expected to be carried out at the Cannington Mine in Queensland by BHP Minerals Ltd. and at the George Fisher and the Hilton Mines in Queensland by MIM Holdings Ltd. Teck Cominco Corp. of Canada reopened its Lennard Shelf Mine in 2008. Several smaller zinc mines, such as Angas Zinc, Browns Silver, Hellyer Metals, and Jaguar, were planned and could produce 1.9 Mt/yr of zinc concentrate by 2011. In China, reported capacity additions were for Aerhada Mining Co. Ltd. and Bayannur Zijin Nonferrous Metal Co. Ltd. to start construction of a 100,000-t/yr zinc smelter in Dong Ujinqin and Urad Houqi, respectively, in the Nei Mongol Autonomous Region in 2008. In Japan, Toyoha Mining Co. Ltd. closed its lead-zinc-silver mine in Hokkaido Prefecture in 2006 because of depletion of ores, but the closure would not affect the increasing regional production of mined zinc.

In China, Tongquan Chizhou Nonferrous Metals Co. planned to add 100,000 t/yr of output capacity at its zinc metal operation in 2010. China's zinc metal output capacity was expected to increase by 300,000 t/yr in 2008 with expansions by such producers as Baiyin Nonferrous Metals Co. Ltd., Nandan Nanfang Co., and Yuguang Gold-Lead Co. Ltd. Zhuzhou Smelter Co. Ltd. was expected to add 130,000 t/yr of capacity in 2009. China did not produce sufficient lead and zinc concentrates to meet its projected smelter expansions and would continue to depend on imports to meet its domestic needs. In India, Hindustan Zinc Ltd. planned to increase its zinc smelting capacity to 1 Mt/yr in 2010 from 570,000 t/yr in 2008.

In 2008, refined zinc consumption in the Asia and the Pacific region accounted for about 57% of the world total, which was a 2.2% increase from that of 2007. The region's increase in zinc consumption was attributable mainly to China, which accounted for about 35% of the world total in 2008. The demand for zinc plate by the automobile and electronics sectors in China was expected to increase. Japan's zinc consumption increased to 3.7% of the world total in 2008 from 5.2% in 2007 owing to increased manufacturing production. Zinc consumption in the Republic of Korea, India, and Taiwan accounted for 4%, 3.7%, and 2%, respectively, of the world total in 2008. As a result, the region's zinc consumption was expected to increase at a moderate rate during the next several years.

Industrial Minerals

Diamond.—The Asia and the Pacific region's production of diamond accounted for about 10.3% of the world total in 2008. Australia was the leading diamond producing country in the region. Diamond produced from Australia accounted for about 10.2% of the world total. Regional production of diamond was expected to increase at an average annual rate of about 6.5% between 2008 and 2015 (table 19). The Argyle Mine, which is located in the Ellendale diamond province in Western Australia, was Australia's largest and the world's leading producing diamond mine. Rio Tinto Ltd. invested $760 million to develop the underground operation at the Argyle Mine for production in 2010, and the open pit operation was shut down in 2008 owing to a wall failure at the end of 2007. Gem Diamonds Ltd. planned to increase the processing of diamondiferous materials at its Ellendale Mine to 8.5 Mt in 2008 and 10.5 Mt in 2009. The quality of diamond from Australia was considered low compared with that from Angola, Central African Republic, Guyana, India, Indonesia, and Sierra Leone. In 2008, the region imported about 43% of the world's total volume (in terms of carats) and exported about 15% of the world total. India was the leading diamond importing country in the region and was ranked second in the world after the European Union. Australia exported most of its diamond output (Kimberley Process Rough Diamond Statistics, 2009).

Lithium.—In 2008, lithium sources in the world came mainly from brine (63%) and lithium mineral concentrate (37%). The region's production of lithium accounted for about 32% of the world total in lithium mineral concentrate in 2008. Chile and Argentina accounted for about 58% of the total in brines. Regional production of lithium was expected to increase slightly at an average annual rate of 0.7% between 2008 and 2015. Australia was the region's leading producer of lithium followed by China. In Australia, Talison Minerals Pty Ltd. produced spodumene concentrate from its Greenbushes Mine in Western Australia, which had a resource of 35.5 Mt at an average grade of 3.31% lithium oxide. The company had a production capacity of 150,000 t/yr of spodumene. Galaxy Resource Ltd.'s Mount Cattlin lithium-tantalum project north of Ravensthorpe in Western Australia could begin production in late 2009 or early 2010 with 120,000 t/yr of concentrate containing 7,200 t of lithium oxide (table 20).

In China, lithium carbonate was produced from either domestic or imported spodumene. The output capacity was about 20,000 t/yr of lithium carbonate and was expected to increase to 60,000 t/yr in 2010. Zabuye Lithium High-Tech Co. Ltd. had a production capacity of 7,500 t/yr of lithium salt, of which 75% was lithium carbonate, and was expected to increase output by 20,000 t/yr. Its Baiyin Zabuye Lithium Co. Ltd. processed 5,000 t/yr of lithium salt to produce 3,000 t/yr of lithium carbonate and 2,000 t/yr of lithium hydroxide. The processing capacity was expected to increase to 25,000 t/yr.

In recent years, lithium use in batteries has increased significantly owing to rechargeable lithium batteries being used increasingly in portable electronic devices and electric tools. Major automobile companies were developing lithium batteries for hybrid vehicles. The world's demand for lithium carbonate equivalent was about 115,000 t in 2008, which was an increase of 1% compared with that of 2007, and about 23% of which was used in primary and rechargeable batteries. In terms of lithium product, demand for lithium carbonate accounted for 46%; lithium mineral concentrate, 21%; and lithium hydroxide, 13%. In Japan, imports of lithium product came mainly from Chile, which accounted for 70% of Japan's lithium imports. In 2008, Japan exported 13,194 t of lithium carbonate mainly to Chile, and 2,406 t of lithium hydroxide and 134 t of lithium metal mainly to the United States and China. Japan's demand for lithium carbonate, lithium hydroxide, and lithium metal was 14,000 t, 2,700 t, and 412 t, respectively, 40% of which was used in batteries.

Mineral Fuels and Related Materials

Coal.—The region's overall production of coal, which included anthracite, bituminous, and lignite, accounted for about 65% of the world total in 2008. Production of anthracite coal, however, accounted for about 94% of the world total, and production of bituminous coal accounted for about 61%. China, which was by far the world's leading producer of anthracite and bituminous coals, accounted for about 75% and 42%, respectively, of the world total. In the Asia and the Pacific region, North Korea and Vietnam were the other significant producers of anthracite coal; Australia, India, and Indonesia were the other important producers of bituminous coal and lignite (table 4). Japan was one of the world's leading importers and consumers of coal; virtually all coal requirements for its iron and steel and utility industries were imported. Australia ranked as the world's leading coal exporter. The other major regional coal exporters (suppliers) were China and Indonesia.

Overall regional coal production was expected to increase at an average annual rate of about 2.6% between 2008 and 2015 (table 21). This prediction takes into account planned capacity expansions and newly developed mines. In Australia, capacity expansion to 12 Mt/yr from 8 Mt/yr at the Rollestone coal mine in Queensland was expected in later years following completion of the second phase of development. The Wilpinjong coal mine in New South Wales was scheduled to produce 13 Mt/yr in

2011. Capacity expansions of several coal mines in the Bowen Basin in Queensland were expected to be completed in the next 2 to 3 years; the Dawson Mine would have the capacity to produce 12.7 Mt/yr in 2011. In China, the Government approved Shenhua Coal Group's application to develop the Buertai Coal Mine in Nei Mongol Autonomous Region, which would have a design capacity of 20 Mt/yr of coal in 2010. The Shanxi Provincial government projected that 70 Mt/yr of coal output capacity would be added in Shanxi Province; the Province was expected to produce 680 Mt of coal in 2008. In India, Coal India Ltd. expanded its output capacity and planned to increase it to 504 Mt/yr in 2011. In Indonesia, Bumi Resources planned to increase production capacity to 20 Mt/yr in 2010. In Mongolia, companies that held exploitation licenses for such coal mines as Baruun Naran, Ovoot Tolgoi, and Tavan Tolgoi were waiting for the Mongolian Government to finalize the investment agreements before proceeding with the construction of the mines. When the development work was completed, these mines would have the capacity to produce 8 Mt/yr in 2012.

In the region, Japan, the Republic of Korea, and Taiwan virtually depended on imported coal for their iron and steel and utility industries. China was the leading coal consuming country in the world. Owing to strong electricity demand, production constraints, and mine safety issues at domestic mines, the volume of coal exports decreased and coal imports increased sharply during the past 2 years. China's coal-production bases are located in the northern part of the country and the coal-consuming regions are located in the coastal areas. As a result of rail and port bottlenecks and increased domestic transportation costs, imported coal was more competitive in recent years. The Indian Government aimed to provide electricity to all citizens. To achieve this target, the construction of a number of large coal-fired powerplants was planned. Several of those coal-fired plants would be located in coastal areas and would rely on imported coal. India was expected to increase coal imports from about 29 Mt in 2007 to 70 Mt in 2013 if all the planned coal-fired plants commence operations. Because of low production costs and the ability to increase output capacities, coal exports from Indonesia were expected to increase. A large share of Indonesia's coal exports was expected to be destined for China and India.

Uranium.—The region's uranium resources are located mainly in Australia, which was ranked first in identified recoverable resources of uranium in the world and accounted for 24% of the world total. The country ranked second after Canada in the production of mined uranium in terms of uranium oxide (U_3O_8) content. In Australia, three active mines were in operation, namely, the Beverly, the Olympic Dam, and the Ranger Mines, and two more were under development. A number of undeveloped deposits are located in Northern Territory, Queensland, South Australia, and Western Australia. BHP Billiton planned to expand its Olympic Dam Mine's uranium output to 15,000 t/yr from 4,400 t/yr. In China, most mined uranium was enriched and consumed domestically. China planned to add 10 more nuclear powerplants in the coastal areas during the next 10 years to relieve the electricity shortage in the region. China's uranium consumption was expected to increase, and the country was interested in investing in uranium mines in Australia. Australia exported nearly all its mined uranium in terms of U_3O_8 to China, Japan, and the Republic of Korea within the region and elsewhere to France, Spain, Sweden, the United Kingdom, and the United States. Australia was expected to export about 10,000 t of uranium to China in 2010.

Regional production of mined uranium was expected to increase at an average annual rate of about 4.3% between 2008 and 2015 (table 22). This prediction was based mainly on production capacity expansions in Australia at the Olympic Dam Mine by BHP Billiton and two U_3O_8 in situ leaching operations at the Beverly Mine by Heathgate Resources Pty. Ltd. and at the Honeymoon Mine by Southern Cross Resources Inc. in South Australia. According to the Chinese Government's energy development plan, China's nuclear power generation capacity would increase to between 40,000 and 60,000 megawatts (MW) in 2020 from 8,600 MW in 2007. With an installed nuclear power capacity of 40,000 MW, China would need about 7,000 t of U_3O_8. The Chinese Government encouraged domestic companies to explore for uranium at home and overseas. China National Nuclear Corp. was the only company allowed to mine uranium in the country. India, Japan, and the Republic of Korea also were expected to expand their nuclear power capacities during the period 2008-13. Regional consumption of uranium was expected to increase and would require imports of uranium from African countries, Australia, Canada, and Kazakhstan.

Trade Review

During the past 3 decades, the main source of economic growth in the Asia and the Pacific region has shifted from the export of manufactured goods toward the export of equipment and machinery. This shift was initially led by Japan, followed by the developed economies of Hong Kong, the Republic of Korea, Singapore, and Taiwan, and more recently by the developing countries of China, India, Indonesia, Malaysia, the Philippines, and Thailand. Consequently, trade of raw materials, including mineral commodities, has been significant in volume and value. Trade liberalization and investment policy reforms in developing countries have reduced barriers to trade and investment. The cross-border transshipment of product components and assembly within the vertically integrated production processes increased during the past several years, and the composition of exports was shifted toward intermediate goods. The share of parts and components in imports for manufacturing also was trending upward in the region. By 2008, the volume of imports of parts and components had more than doubled in China, the Philippines, Thailand, and Vietnam. China had become one of the major export destinations of intermediate goods for all economies in the region. The export value to China from such countries as Malaysia, the Philippines, the Republic of Korea, Singapore, and Thailand increased by almost five times during this period, at the expense of the United States and the European Union.

Within the region, Australia continued to rely heavily on exports of most of its mineral output to Asian countries to sustain its mineral development and production. China's imports of raw materials came mostly from Australia, India, and Indonesia. China imported a large quantity of iron ore from Australia and India. Most of Indonesia's coal went to China. Japan was China's leading source of imports for finished products, such as iron and steel products. Japan also relied on imported raw materials for its industrial manufacturing and on imported mineral fuels for its energy needs. The Republic of Korea was a net importer of mineral commodities and depended on imported raw materials to manufacture iron and steel and petroleum products for domestic consumption and export. India continued to be largely self-sufficient in mineral commodities, which were used as primary raw materials in various industries. In mineral trade, Indonesia's major export partners were China, India, Japan, and the Republic of Korea, and its major import partners were China and Japan.

During the past several years, nonfuel commodity prices continued to increase; the prices were supported by strong investment and demand in the region. Metal prices rose by more than 10%, led by aluminum, copper, iron ore, lead, nickel, and precious metals. China's consumption of these metals had grown by more than 100% during the past several years. Growth in Chinese metal demand alone more than offset lower consumption in the European countries. Regional economic integration has facilitated rationalization of industry across the region. The ASEAN has facilitated regional economic integration by inviting all major Asian countries, including Australia, China, Japan, New Zealand, and the Republic of Korea, to discuss investment and trade liberalization in the region.

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TABLE 1
ASIA AND THE PACIFIC: AREA AND POPULATION IN 2008

Country	Area[1] (square kilometers)	Estimated population[2] (thousands)
Afghanistan	647,500	28,396 [1]
Australia	7,687,850	21,374
Bangladesh	144,000	160,000
Bhutan	47,000	687
Brunei	5,770	397
Burma	678,500	49,190
Cambodia	181,040	14,700
China	9,596,960	1,325,640
Fiji	18,270	839
Hong Kong	1,092	6,978
India	3,287,590	1,139,965
Indonesia	1,919,440	228,249
Japan	377,835	127,704
Korea, North	120,540	23,858
Korea, Republic of	98,480	48,607
Laos	236,800	6,205
Malaysia	329,750	26,993
Mongolia	1,564,116	2,632
Nepal	147,181	28,582
New Caledonia	19,060	246
New Zealand	268,680	4,269
Pakistan	803,940	166,037
Papua New Guinea	462,840	6,449
Philippines	300,000	90,348
Singapore	693	4,839
Solomon Islands	28,450	507
Sri Lanka	65,610	20,156
Taiwan	36,190	22,974 [1]
Thailand	514,000	67,386
Timor, East	15,007	1,098
Vietnam	329,560	86,211
Total	29,933,744	3,711,516
World total	148,940,000	6,692,030

[1] Source: U.S. Central Intelligence Agency, The World Factbook 2009.

[2] Source: The World Bank, 2008 World Development Indicators Database.

TABLE 2
ASIA AND THE PACIFIC: GROSS DOMESTIC PRODUCT IN 2008[1, 2]

	Gross domestic product based on purchasing power parity		Real gross domestic product growth rate (percentage)		
Country	Gross value (million dollars)	Per capita (dollars)	2006	2007	2008
Afghanistan	21,388	760	8.2	12.1	3.4
Australia	799,054	36,918	2.8	4.0	2.4
Bangladesh	226,205	1,399	6.5	6.3	6.0
Bhutan	3,490	5,312	6.3	21.4	7.6
Brunei	19,716	50,199	4.4	0.6	-1.5
Burma	67,963	1,156	13.1	11.9	4.0
Cambodia	28,461	2,082	10.8	10.2	6.7
China	7,926,500	5,970	11.6	13.0	9.0
Fiji	3,678	4,196	3.3	-6.6	0.2
Hong Kong	307,318	43,847	7.0	6.4	2.4
India	3,297,840	2,780	9.8	9.4	7.3
Indonesia	909,729	3,980	5.5	6.3	6.1
Japan	4,356,320	34,116	2.0	2.3	-0.7
Korea, North[3]	40,000	1,800	NA	NA	NA
Korea, Republic of	1,344,540	27,692	5.2	5.1	2.2
Laos	13,310	2,127	8.4	7.5	7.2
Malaysia	384,388	14,082	5.8	6.2	4.6
Mongolia	9,414	3,547	8.6	10.2	8.9
Nepal	31,634	1,144	3.7	3.2	4.7
New Caledonia[4]	3,158	15,000	NA	NA	NA
New Zealand	115,809	27,083	2.0	3.2	0.2
Pakistan	422,392	2,624	6.1	5.6	2.0
Papua New Guinea	13,064	2,108	2.6	6.5	7.0
Philippines	317,964	3,515	5.3	7.1	3.8
Singapore	239,146	51,226	8.4	7.8	1.1
Solomon Islands	1,525	2,917	6.9	10.7	6.9
Sri Lanka	92,168	4,589	7.7	6.8	6.0
Taiwan	712,117	30,912	4.8	5.7	0.1
Thailand	547,060	8,239	5.2	4.9	2.6
Timor, East	2,522	2,368	-5.8	8.4	12.8
Vietnam	240,757	2,794	8.2	8.5	6.2
Total	22,498,630	XX	XX	XX	XX
World total	69,489,850	XX	XX	XX	XX

NA Not available. XX Not applicable.

[1] Source: International Monetary Fund, World Economic Outlook Database, October 2009.

[2] Gross domestic product listed may differ from that reported in individual country chapters owing to differences in source or date of reporting.

[3] Based on a 2008 estimate, U.S. Central Intelligence Agency World Factbook 2009.

[4] Based on 2003 estimate, U.S. Central Intelligence Agency World Factbook 2009.

TABLE 3
ASIA AND THE PACIFIC: SELECTED EXPLORATION SITES IN 2008[1]

Country	Type[2]	Site	Commodity	Company	Resources[3]	Exploration[4]
Australia	F	Balmoral South	Fe	Australasian Resources Ltd.	234 Mt Fe	Extensive drilling.
Do.	P	Boddington	Au, Cu	Newmont Mining Corp.	5.6 Moz Au, 304,000 t Cu	Do.
Do.	D	Kalgoorlie Nickel	Ni, Co	Vale Inc./Heron Resources Ltd.	2 Mt Ni, 146,000 t Co	Do.
Do.	F	Mt. Karara	Fe	Gindalbie Mining Ltd.	500 Mt Fe	Do.
Do.	P	Olympic Dam	Au, U, Ag, Cu	BHP Billiton Ltd.	14.7 Mt Cu, 440,000 t U_3O_8, 13.7 Moz Au, 92.7 Moz Ag	Extensive work program.
Do.	P	Ravenswood	Au	Resolute Mining Ltd.	745,000 oz Au	Extensive drilling.
Do.	D	Sino Iron/Cape Preston	Fe	CITIC Pacific Mining Corp.	Data not released	Do.
Do.	E	Tropicana	Au	AngloGold Ashanti Ltd.	3.5 Moz Au	Do.
Do.	E	West Pilbara	Fe	Aquila Resources Ltd.	139 Mt Fe	Extensive work program.
Do.	E	Yerilla (Jump Up Dam)	Ni, Co	Heron Resource Ltd.	570,000 t Ni, 36,000 t Co	Extensive drilling.
China	E	Changkeng	Au	Minco Gold Corp.	379,000 oz Au	Do.
Do.	E	Dachang	Au	InterCitic Minerals Inc.	2.6 Moz Au (inferred)	Do.
Do.	D	White Mountain	Au	Sino Gold Mining Ltd.	1.07 Moz Au	Do.
Mongolia	F	Oyu Tolgoi	Au, Cu	Ivanhoe Mines Ltd.	10.5 Moz Au, 13.6 Mt Cu	Do.
Pakistan	F	Reko Diq	Cu, Au	Antofagasta plc./Barrick Gold Corp.	8.3 Mt Cu, 13.6 Moz Au	Do.
Papua New Guinea	E	Frieda	Cu, Au	Xstrata plc	2.2 Mt Cu, 2.9 Moz Au	Do.
Do.	E	Solwara	Cu, Au, Ag, Zn	Nautilus Minerals Inc.	59,000 t Cu, 134,000 oz Au, 640,000 oz Ag, 3,500 t Zn	Extensive work program.
Tonga	E	Tahi Moana	Zn, Cu, Ag, Au	do.	Data not released	Do.

Do., do. Ditto.

[1] Abbreviations used for commodities in this table include the following: Ag, silver; Au, gold; Co, cobalt; Cu, copper; Fe, iron ore; Ni, nickel; U, uranium; U_3O_8, uranium oxide; Zn, zinc.

Abbreviations used for units of measure include the following: Moz, million troy ounces; Mt, million metric tons; oz, troy ounces; t, metric tons.

[2] D, Approved for development; E, Active exploration; F, Feasibility work ongoing/completed; P, Exploration associated with producing site.

[3] Resources reported where available based on 2008 data from various sources and reflect unverified public information reported by trade journals. Sites reflect measured + indicated resource unless otherwise noted.

[4] Sites where extensive (greater than 10,000 meters) drilling or significant (more than $5 million) expenditures have been reported.

TABLE 4
ASIA AND THE PACIFIC: PRODUCTION OF SELECTED COMMODITIES IN 2008[1]

(Thousand metric tons unless otherwise specified)

	Metals										
	Aluminum			Copper		Gold, mine output, Au content (kilograms)	Iron and steel			Lead	
							Iron				
Country	Alumina	Bauxite	Metal[2]	Mine output, Cu content	Refined, primary		Ore, gross weight	Pig	Steel, crude	Mine output, Pb content	Refined, primary
Afghanistan	--	--	--	--	--	--	--	--	--	--	--
Australia	19,446	64,038	2,104	885	503	215,000	342,000 [e]	6,409	7,724	645	220
Bangladesh	--	--	--	--	--	--	--	--	--	--	--
Bhutan	--	--	--	--	--	--	--	--	--	--	--
Brunei[3]	--	--	--	--	--	--	--	--	--	--	--
Burma	--	--	--	7	7	100 [e]	--	2 [e]	25 [e]	4 [e]	(4)
Cambodia	--	--	--	--	--	--	--	--	--	--	--
China[e]	22,800	35,000	15,900	940	2,700	285	824,000	470,670 [5]	500,490 [5]	1,550	2,350
Christmas Island	--	--	--	--	--	--	--	--	--	--	--
Fiji	--	--	--	--	--	638	--	--	--	--	--
Hong Kong[3]	--	--	--	--	--	--	--	--	--	--	--
India[e]	3,000	21,210 [5]	1,308 [5]	31 [5]	684 [5]	--	220,000 [5]	29,000 [5]	55,200 [5]	87 [5]	62 [5]
Indonesia	--	1,152	243	651	181	64,390	--	--	3,915	--	--
Japan	320 [e]	--	1,158	--	1,328	6,868	--	86,171	118,739	--	107
Korea, North[e]	--	--	--	12	15	2,000	5,316	900	1,279 [5]	13	9
Korea, Republic of	--	--	--	(4)	514	175	366	31,043	53,322	(4)	244
Laos[e]	--	--	--	100	64	4,300	--	--	--	--	--
Malaysia	--	150 [e]	--	--	--	2,400 [e]	800 [e]	--	6,423	--	--
Mongolia	--	--	--	127	3	15,184	1,387	--	81	--	--
Nauru	--	--	--	--	--	--	--	--	--	--	--
Nepal	--	--	--	--	--	--	--	--	--	--	--
New Caledonia	--	--	--	--	--	--	--	--	--	--	--
New Zealand	--	--	338	--	--	16,274	--	600 [e]	853 [e]	--	--
Pakistan[e]	--	8	--	19	--	--	250	105,000	1,100	--	--
Papua New Guinea	--	--	--	187	--	64,000	--	--	--	--	--
Philippines	--	--	--	21	174	35,568	--	--	711 [e]	--	--
Singapore	--	--	--	--	--	--	--	--	620 [e]	--	--
Solomon Islands	--	--	--	--	--	--	--	--	--	--	--
Sri Lanka[e]	--	--	--	--	--	--	--	--	--	--	--
Taiwan	--	--	--	--	--	--	--	9,800	19,222	--	--
Thailand	--	--	--	--	--	2,721	1,710	--	5,211	--	--
Vietnam[e]	--	30	--	11	2	3,000	1,060	800	2,250	19	--
Total	45,600	122,000	21,100	2,990	6,180	433,000	1,400,000	740,000	777,000	2,320	2,990
Share of world total	55%	57%	44%	19%	40%	22%	63%	72%	58%	58%	70%
United States	4,300	NA	2,660	1,310	1,220	233,000	53,600	33,700	91,900	410	135
World total	82,400	213,000	47,400	15,500	15,600	1,970,000	2,210,000	1,030,000	1,330,000	3,980	4,270

See footnotes at end of table.

TABLE 4—Continued
ASIA AND THE PACIFIC: PRODUCTION OF SELECTED COMMODITIES IN 2008[1]

(Thousand metric tons unless otherwise specified)

	Metals								
	Manganese ore,	Mercury,	Nickel, metal content		Tin, metric tons		Tungsten,	Zinc, metric tons	
Country	mine output, Mn content	mine output, Hg content (metric tons)	Mine output	Refinery products	Mine output, Sn content	Metal, primary	mine output, W content (metric tons)	Mine output, Zn content	Metal[2]
Afghanistan	--	--	--	--	--	--	--	--	--
Australia	2,310	--	188	103	1,783	--	--	1,519,000	505,000
Bangladesh	--	--	--	--	--	--	--	--	--
Bhutan	--	--	--	--	--	--	--	--	--
Brunei[3]	--	--	--	--	--	--	--	--	--
Burma	(4)	--	(4)	--	1	30 [e]	136	20	--
Cambodia	--	--	--	--	--	--	--	--	--
China[e]	2,200	800	72	129	110,000	129,000	43,500	3,200,000	4,000,000
Christmas Island	--	--	--	--	--	--	--	--	--
Fiji	--	--	--	--	--	--	--	--	--
Hong Kong[3]	--	--	--	--	--	--	--	--	--
India[e]	960	--	--	--	--	--	--	337,000	568,000
Indonesia	--	--	193	9	53,228	53,471	--	--	--
Japan	--	--	--	156 [e]	--	956	--	--	632,576
Korea, North[e]	--	--	--	--	--	--	350	70,000	75,000
Korea, Republic of	--	--	--	3 [e]	--	--	--	3,672	948,000
Laos[e]	--	--	--	--	700	--	--	1,100	--
Malaysia	--	--	--	--	2,578	31,630	--	--	--
Mongolia	--	--	--	--	--	--	142	71,800	--
Nauru	--	--	--	--	--	--	--	--	--
Nepal	--	--	--	--	--	--	--	--	--
New Caledonia	--	--	103 [p]	38 [p]	--	--	--	--	--
New Zealand	--	--	--	--	--	--	--	--	--
Pakistan[e]	--	--	--	--	--	--	--	--	--
Papua New Guinea	--	--	--	--	--	--	--	--	--
Philippines	--	--	84	--	--	--	--	1,619	--
Singapore	--	--	--	--	--	10 [e]	--	--	--
Solomon Islands	--	--	--	--	--	--	--	--	--
Sri Lanka[e]	--	--	--	--	--	--	--	--	--
Taiwan	--	--	--	11 [e]	--	--	--	--	--
Thailand	53 [e]	--	--	--	169	21,860	778 [e]	17,811	107,753
Vietnam[e]	4	--	--	--	3,500	3,566 [5]	--	45,000	--
Total	5,530	800	639	448	172,000	241,000	44,900	5,270,000	6,840,000
Share of world total	39%	67%	25%	34%	67%	79%	79%	47%	58%
United States	--	NA	--	--	--	--	--	778,000	286,000
World total	14,100	1,190	2,540	1,310	256,000	304,000	56,500	11,300,000	11,800,000

See footnotes at end of table.

TABLE 4—Continued
ASIA AND THE PACIFIC: PRODUCTION OF SELECTED COMMODITIES IN 2008[1]

(Thousand metric tons unless otherwise specified)

	Industrial minerals						Mineral fuels			
							Coal			
Country	Cement, hydraulic	Fluorspar (metric tons)	Graphite (metric tons)	Magnesite	Mica (metric tons)	Salt	Anthracite	Bituminous	Natural gas, dry (million cubic meters)	Petroleum, crude (thousand 42-gallon barrels)
Afghanistan	50 ^{e}	--	--	--	--	--	--	150 ^{e}	50 ^{e}	20 ^{e}
Australia	9,400 ^{e}	--	--	126,000	--	11,160	--	332,000	38,256	168,123
Bangladesh	5,000 ^{e}	--	--	--	--	360 ^{e}	--	--	18,516	1,800 ^{e}
Bhutan	180 ^{e}	--	--	--	--	--	--	124	--	--
Brunei[3]	240 ^{e}	--	--	--	--	--	--	--	11,400 ^{e}	63,000
Burma	676	--	--	--	--	35 ^{e}	--	--	12,445	7,242
Cambodia	772	--	--	--	--	78 ^{e}	--	--	--	--
China^{e}	1,388,380 [5]	3,250,000	800,000	10,000	--	59,520 [5]	460,000	2,150,000	66,000	1,380,000
Christmas Island	--	--	--	--	--	--	--	--	--	--
Fiji	143 ^{e}	--	--	--	--	--	--	--	--	--
Hong Kong[3]	--	--	--	--	--	--	--	--	--	--
India^{e}	180,000	7,000	140,000	350	4,000	16,000	--	420,000	27,457 [5]	253,000
Indonesia	37,000 ^{e}	--	--	--	--	700 ^{e}	54,000 ^{e}	188,717	78,985	311,000
Japan	62,810	--	--	--	--	1,200 ^{e}	--	1,300 ^{e}	3,900 ^{e}	6,200
Korea, North^{e}	6,415 [5]	12,500	30,000	150	--	500	17,781 [5]	--	--	--
Korea, Republic of	51,653	--	73	--	49,474	384	2,773	--	--	--
Laos^{e}	400	--	--	--	--	35	--	--	--	--
Malaysia	19,000 ^{e}	--	--	--	6,000 ^{e}	--	--	1,050 ^{e}	57,648	253,310
Mongolia	270	335,000	--	--	--	(4)	--	9,692	--	1,174
Nauru	--	--	--	--	--	--	--	--	--	--
Nepal	295 ^{e}	--	--	--	--	2 ^{e}	--	16 ^{e}	--	--
New Caledonia	NA ^{p}	--	--	--	--	--	--	--	--	--
New Zealand	1,200 ^{e}	--	--	--	--	100 ^{e}	--	4,909	3,994	21,298
Pakistan^{e}	22,000	1,400	--	2	--	1,710 ^{e}	--	4,200	38,000	26,000
Papua New Guinea	--	--	--	--	--	--	--	--	135 ^{e}	12,400
Philippines	13,369	--	--	--	--	510	--	3,610	--	965
Singapore	--	--	--	--	--	--	--	--	--	--
Solomon Islands	--	--	--	--	--	--	--	--	--	--
Sri Lanka^{e}	1,800	--	10,000	--	3,600	70	--	--	--	--
Taiwan	17,330	--	--	--	3,179	--	--	--	310 ^{e}	101
Thailand	35,668	29,529	--	--	--	1,312	--	--	25,400	53,151
Vietnam^{e}	40,047 [5]	4,000	2,000	--	--	847 [5]	39,777 [5]	--	7,944 [5]	109,291 [5]
Total	1,890,000	3,640,000	982,000	137,000	66,300	94,500	574,000	3,120,000	390,000	2,670,000
Share of world total	67%	77%	88%	96%	21%	37%	94%	61%	13%	10%
United States	87,600	--	--	W	84,000	47,300	1,540	993,000	577,000	1,940,000
World total	2,840,000	4,720,000	1,110,000	143,000	313,000	256,000	613,000	5,070,000	2,990,000	27,700,000

See footnotes at end of table.

TABLE 4—Continued

ASIA AND THE PACIFIC: PRODUCTION OF SELECTED COMMODITIES IN 2008[1]

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[e] Estimated; estimated data, U.S. data, and world totals are rounded to no more than three significant digits. [p]Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; not included in world total. -- Zero or zero percent.

[1] Totals may not add due to independent rounding. Percentages are calculated on unrounded data. Table includes data available as of June 21, 2010.

[2] Primary and secondary production.

[3] Not in Minerals Yearbook, volume III.

[4] Less than 1/2 unit.

[5] Reported figure.

TABLE 5
ASIA AND THE PACIFIC: HISTORIC AND PROJECTED BAUXITE MINE PRODUCTION, 1995-2015[1]

(Thousand metric tons, gross weight)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	42,700	53,800	59,960	64,038	67,000	80,000	85,000
China	5,000	9,000	22,000	35,000	43,000	45,000	46,000
India	5,240	7,560	12,385	21,210	23,000	24,000	25,000
Indonesia	899	1,150	1,442	1,152	2,100	2,200	2,300
Malaysia	184	123	5	150	150	150	150
Other	3	9	33	38	47	46	55
Total	54,000	71,600	95,800	122,000	140,000	150,000	160,000

[e] Estimated.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 6
ASIA AND THE PACIFIC: HISTORIC AND PROJECTED PRIMARY AND SECONDARY ALUMINUM METAL PRODUCTION, 1995-2015[1]

(Thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	1,300	1,770	2,030	2,100	2,000	2,100	2,100
China	1,750	2,800	9,740	15,900	18,000	19,000	20,000
India	537	644	942	1,308	1,700	1,900	2,100
Indonesia	220	160	252	243	260	270	280
Japan	1,280	1,217	1,039	1,100	1,000	1,000	1,000
New Zealand	273	328	373	338	380	380	380
Other	--	--	--	--	800	1,000	1,000
Total	5,360	6,920	14,400	21,000	24,000	26,000	27,000

[e] Estimated. -- Negligible or no production.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 7
ASIA AND THE PACIFIC: HISTORIC AND PROJECTED COPPER MINE PRODUCTION, 1995-2015[1]

(Metal content in thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	398	829	930	885	970	1,000	1,100
China	445	593	762	940	1,000	1,100	1,200
India	47	32	27	31	37	39	42
Indonesia	444	1,010	1,064	651	1,000	1,300	1,200
Mongolia	122	125	127	127	130	160	200
Papua New Guinea	213	203	193	187	120	130	200
Philippines	108	130	16	21	25	25	25
Other	26	44	95	135	210	220	220
Total	1,800	2,970	3,210	2,980	3,500	4,000	4,200

[e] Estimated.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 8

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED REFINED COPPER METAL PRODUCTION, 1995-2015[1]

(Thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	248	488	461	503	470	490	490
China	1,080	1,370	2,600	4,100	4,400	4,400	4,600
India	40	243	497	684	720	740	770
Indonesia	--	158	263	181	280	380	380
Japan	1,190	1,440	1,395	1,540	1,500	1,500	1,500
Korea, Republic of	235	468	519	514	600	600	600
Philippines	158	150	172	174	180	190	190
Other	29	45	98	89	260	270	270
Total	2,980	4,360	6,010	7,790	8,400	8,600	8,800

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 9

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED GOLD MINE PRODUCTION, 1995-2015[1]

(Metal content in kilograms)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	254,000	269,000	263,000	215,000	230,000	240,000	250,000
China	140,000	180,000	225,000	285,000	330,000	340,000	360,000
Indonesia	64,000	125,000	130,620	64,390	110,000	130,000	120,000
Japan	9,190	8,400	8,300	6,868	7,000	6,700	6,500
Laos	--	--	7,058	4,300	5,000	5,000	5,000
Mongolia	4,500	11,800	24,120	15,184	25,000	25,000	35,000
New Zealand	12,100	9,880	10,583	16,274	17,000	17,000	17,000
Papua New Guinea	51,700	74,500	68,483	64,000	70,000	70,000	80,000
Philippines	27,000	36,500	37,490	35,568	40,000	42,000	42,000
Other	14,404	23,961	19,037	13,734	17,000	17,000	16,000
Total	577,000	739,000	794,000	720,000	850,000	890,000	930,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 10

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED BENEFICIATED IRON ORE PRODUCTION, 1995-2015[1]

(Metal content in thousand metric tons)

Country	Average ore grade (% Fe)	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	62	88,700	107,000	163,000	208,000	290,000	330,000	340,000
China	64	82,300	73,600	134,000	263,000	310,000	320,000	330,000
India	64	41,700	48,600	97,500	141,000	140,000	150,000	150,000
Korea, North	NA	2,000	1,100	1,400	1,488	5,000	5,000	5,000
Other		1,242	1,477	2,195	2,940	2,900	2,800	2,800
Total		216,000	232,000	398,000	616,000	750,000	810,000	830,000

[e]Estimated. NA Not available.

[1]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 11
ASIA AND THE PACIFIC: HISTORIC AND PROJECTED CRUDE STEEL PRODUCTION, 1995-2015[1]

(Thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	8,450	7,300	7,790	7,724	8,400	8,400	8,400
China	95,400	129,000	353,240	500,490	620,000	640,000	680,000
India	22,800	26,900	45,800	55,200	75,000	90,000	92,000
Japan	102,000	106,400	112,470	118,739	120,000	130,000	140,000
Korea, Republic of	36,800	43,100	47,820	53,322	52,000	52,000	61,000
Malaysia	2,450	2,430	5,296	6,423	6,100	6,500	7,000
Taiwan	11,600	17,300	18,567	19,222	22,000	23,000	23,000
Thailand	2,134	2,100	5,161	5,211	5,300	5,400	5,500
Other	7,221	6,024	7,929	10,214	13,000	15,000	18,000
Total	289,000	341,000	604,000	777,000	930,000	970,000	1,030,000

[e] Estimated.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 12
ASIA AND THE PACIFIC: HISTORIC AND PROJECTED NICKEL MINE PRODUCTION, 1995-2015[1]

(Metal content in metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	103,000	167,000	192,000	188,000	190,000	200,000	220,000
Burma	13	10	10	10	22,000	22,000	22,000
China	41,800	50,300	72,700	72,000	84,000	85,000	85,000
Indonesia	88,200	98,200	135,000	192,600	240,000	270,000	300,000
New Caledonia	120,000	126,000	111,939	102,700	110,000	120,000	120,000
Papua New Guinea	--	--	--	--	30,000	32,000	60,000
Philippines	15,100	17,400	26,636	83,895	100,000	100,000	100,000
Total	368,000	459,000	538,000	639,000	780,000	830,000	910,000

[e] Estimated. -- Negligible or no production.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 13
ASIA AND THE PACIFIC: HISTORIC AND PROJECTED PLATINUM MINE PRODUCTION, 1995-2015[1]

(Metal content in kilograms)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	100	171	111	200	200	200	200
China	300	650	700	800	1,000	1,000	1,000
Total	400	821	811	1,000	1,200	1,200	1,200

[e] Estimated.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 14

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED PALLADIUM MINE PRODUCTION, 1995-2015[1]

(Metal content in kilograms)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	400	812	550	700	650	650	700
China	170	350	450	500	650	650	700
Total	570	1,160	1,000	1,200	1,300	1,300	1,400

[e] Estimated.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 15

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED TIN MINE PRODUCTION, 1995-2015[1]

(Metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	8,656	9,146	2,819	1,783	4,000	4,000	4,000
China	61,900	99,400	126,000	110,000	150,000	150,000	150,000
Indonesia	46,058	55,624	78,404	53,228	60,000	70,000	80,000
Malaysia	6,402	6,307	2,857	2,578	2,000	2,000	2,000
Thailand	2,201	1,930	158	169	1,000	2,000	3,000
Vietnam	4,500	1,800	3,500	3,500	3,500	3,500	3,500
Other	981	1,152	1,158	1,441	1,500	1,500	1,500
Total	131,000	175,000	215,000	173,000	220,000	230,000	240,000

[e] Estimated.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 16

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED TIN METAL PRODUCTION, 1995-2015[1]

(Metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	870	1,033	994	400	500	500	500
China	67,700	112,000	122,000	129,000	140,000	150,000	150,000
Indonesia	38,628	47,129	65,300	53,471	55,000	65,000	75,000
Japan	630	593	754	956	900	900	900
Malaysia	39,433	26,228	36,924	31,630	27,000	30,000	30,000
Thailand	8,243	17,076	31,600	21,860	23,000	23,000	24,000
Other	2,690	1,830	1,796	3,596	3,500	3,500	3,500
Total	159,000	206,000	259,000	241,000	250,000	270,000	280,000

[e] Estimated.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 17

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED ZINC MINE PRODUCTION, 1995-2015[1]

(Metal content in thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	937	1,420	1,367	1,519	1,500	1,500	1,500
China	1,011	1,780	2,550	3,200	3,200	3,300	3,300
India	155	144	262	337	350	370	400
Korea, North	210	60	67	70	70	70	70
Thailand	29	27	31	18	30	30	33
Vietnam	14	13	48	45	50	50	50
Other	96	65	55	75	74	76	76
Total	2,450	3,510	4,380	5,260	5,300	5,400	5,400

[e] Estimated.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 18

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED PRIMARY AND SECONDARY ZINC METAL PRODUCTION, 1995-2015[1]

(Thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	325	495	463	505	500	500	500
China	1,077	1,980	2,780	4,000	4,200	4,300	4,400
India	171	201	289	568	800	1,000	1,000
Japan	711	699	675	633	630	620	610
Korea, North	200	65	72	75	100	100	75
Korea, Republic of	279	474	645	948	900	900	900
Thailand	46	78	61	108	110	110	100
Total	2,810	3,990	4,990	6,840	7,200	7,500	7,600

[e] Estimated.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 19

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED DIAMOND PRODUCTION, 1995-2015[1]

(Thousand carats)

Country (average % gem grade)	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	40,693	26,648	34,307	15,670	23,000	23,000	23,000
China	1,130	1,150	100	100	100	100	100
India	21	16	16	15	14	14	13
Indonesia	29	30	30	35	30	30	30
Total	41,900	27,800	34,500	15,800	23,000	23,000	23,000

[e] Estimated.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 20

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED LITHIUM PRODUCTION, 1995-2015[1]

(Metal content in metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	9,800	9,800	21,000	29,000	30,000	30,000	30,000
China	1,700	1,700	1,900	2,500	2,600	2,700	2,700
Total	11,500	11,500	22,900	31,500	33,000	33,000	33,000

[e] Estimated.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 21

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED SALABLE COAL PRODUCTION, 1995-2015[1]

(Thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	244,200	313,000	370,000	403,000	450,000	480,000	480,000
China	1,361,000	999,000	2,260,000	2,720,000	3,100,000	3,200,000	3,300,000
India	290,011	334,800	360,000	446,000	470,000	500,000	520,000
Indonesia	39,936	77,015	142,920	188,717	190,000	200,000	200,000
Japan	6,263	3,126	1,114	1,300	--	--	--
Korea, North	71,000	16,000	23,500	25,060	25,000	25,000	25,000
Korea, Republic of	5,720	4,174	2,832	2,773	2,700	2,600	2,700
Mongolia	5,019	5,185	8,256	9,692	15,000	17,000	18,000
New Zealand	3,445	3,586	5,267	4,909	5,500	6,000	6,000
Pakistan	2,997	3,116	3,367	4,200	4,300	4,400	4,500
Philippines	1,200	1,218	3,165	3,610	3,500	3,500	3,500
Thailand	18,419	17,786	21,429	18,095	20,000	20,000	20,000
Vietnam	8,350	11,609	34,093	39,777	40,000	50,000	60,000
Other	407	837	1,531	2,189	2,200	2,300	2,300
Total	2,060,000	1,790,000	3,240,000	3,870,000	4,300,000	4,500,000	4,600,000

[e] Estimated. -- Negligible or no production.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 22

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED URANIUM MINE PRODUCTION, 1995-2015[1]

(U_3O_8 content in metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Australia	3,712	7,588	11,218	9,989	11,000	12,000	13,000
China	500	1,000	1,200	1,300	1,500	2,000	2,000
Total	4,200	8,590	12,400	11,300	13,000	14,000	15,000

[e] Estimated.

[1] Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

THE MINERAL INDUSTRY OF AFGHANISTAN

By Chin S. Kuo

Afghanistan has abundant mineral resources, including copper, gold, iron ore, lead, marble, nickel, rubies, sulfur, and talc. Construction minerals included clay for bricks, dimension stone, limestone for cement, rock aggregate, and sand and gravel. Poor infrastructure, a shortage of skilled labor, and security problems have been a hindrance to the development and mining of these resources and to investment by local and foreign companies. To rebuild its infrastructure, the country would most likely need to open market opportunities for construction minerals and equipment. The country's output of construction and other industrial minerals did not keep pace with the strong domestic demand for them.

According to the U.S. Geological Survey (USGS), Afghanistan has significant amounts of undiscovered nonfuel mineral resources. Copper resources (identified and undiscovered) were estimated to be nearly 60 million metric tons (Mt) of copper. The Aynak copper deposit was estimated to contain 12.3 Mt of copper. Iron ore resources (identified) were estimated to be more than 2,200 Mt of ore. The Haji Gak area was the largest unexploited iron ore deposit in Asia with 2,100 Mt of ore. The country has abundant deposits of colored stones and gemstones, including emerald, garnet, kunzite, lapis, peridot, ruby, sapphire, spinel, and tourmaline. Chromite, gold, graphite, magnesite, mercury, potash, sand and gravel, sulfur, and talc are also available for extraction. Afghanistan was estimated to have undiscovered deposits containing 27.5 Mt of potash (Peters, 2007).

Production

Owing to the lack of mineral production data published by the Government, Afghanistan's mining activities were not readily known but appeared to be limited in scope. In 2008, the production level was estimated to be about 50,000 metric tons (t) of cement, 7,000 t of chromite, 150,000 t of coal, 20,000 barrels of crude oil, and 50 million cubic meters of natural gas. In the process of reconstruction and infrastructure development, output of construction minerals was estimated to have increased to meet the domestic requirements.

Structure of the Mineral Industry

The Ministry of Mines is responsible for a number of functions relating to mineral exploration, licensing, development, and mining. The Afghanistan Geological Survey (AGS) is the national custodian of geoscientific information. It assists and advises the Ministry of Mines on policies related to coal, environmental geology, geotechnology, hydrocarbons, industrial and metalliferous minerals, precious and semiprecious stones, and water resources. In the past several years, the USGS has assisted the AGS in assessing the country's nonfuel mineral resources, as well as its petroleum resources. The British Geological Survey has assisted the AGS in exploring for deposits of copper, gemstones, gold, industrial minerals (mainly marble), iron ore, and rare metals. Foreign and domestic companies began to invest and develop copper and gold deposits, respectively (table 1).

Commodity Review

Metals

The Government signed a contract with Metallurgical Group Corp. (MGC) of China for extraction of copper at the Aynak deposit in the Province of Logar in November 2007. MGC would invest $2.8 billion in the mine, which was estimated to have a resource of more than 12 Mt of contained copper. The mine was leased to MGC for 30 years and MGC would pay $400 million per year in tax to the Government as compensation (Pak Tribune, The, 2008).

An unnamed Afghan private company won the bidding to mine placer gold in the Province of Takhar and planned to invest $40 million for extraction of gold. The project would employ more than 4,000 people in the region. The level of gold production was not specified but the Government would receive 50% of the income from the extracted gold (Pak Tribune, The, 2008).

Afghanistan is known to have a total of 49 recorded occurrences of rare metals found in pegmatitic rocks. Beryllium mineralization in pegmatites was identified in the Provinces of Laghman and Nangarhar and was related to either Oligocene or Early Cretaceous magmatism in metasediments. The Darrahe-Pech deposit in Nangarhar was estimated to have a resource of 12,000 t of beryl (containing 1,480 t of beryllium oxide). Lithium mineralization in pegmatites is found in the Provinces of Badakhshan and Oruzgan in addition to the Provinces of Laghman and Nangarhar. The spodumene-albite pegmatite in the Parun prospect in Nangarhar Province has a grade of 1.5% lithium oxide whereas the pegmatite dykes in the Taghawkor prospect in Oruzgan Province have a grade of between 1.7% and 2.8% lithium oxide. Tantalum and niobium mineralization is found in the Provinces of Badakhshan and Parvan. The prospect with the most potential was Nilaw in Laghman Province (Afghanistan Geological Survey, 2007).

Industrial Minerals

Afghanistan's limestone resources occur in the Provinces of Badakhshan (the Jamarchi-Bolo deposit), Baghlan (the Pul-i-Khumri deposit), Bamyan, and Herat (the Benosh-Darrah, the Darra-i-Chartagh, and the Rod-i-Sanjur deposits). The Sabz quarry in Badakhshan worked on a Lower Carboniferous limestone resource, which was estimated to be 1,300 Mt (Industrial Minerals, 2008). The country's cement plants were outdated and no investment in the industry had been made since the 1970s. Cement output was reported to be 16,000 t, and cement consumption was reported to be 2.5 Mt in 2005 (the latest year for which data were available). In the same year, Afghanistan imported 1.8 Mt of cement from Pakistan, 400,000 t from Iran, and the remaining 300,000 t from Turkmenistan and Uzbekistan. Cement was produced by the only operating Ghuri cement plant at Pul-i-Khumri in the Province of Baghlan. Afghan Investment Co. was in the process of refurbishing the Ghuri plant. The Ghuri I plant had been renovated, the Ghuri II was completed in mid-2008, and the new Ghuri III would be ready by the end of 2009. Cement output was expected to increase to 1.6 million metric tons per year in the next 2 years. Jebel Seraj Cement Enterprise in the Province of Parvan produced cement using clinker purchased from the Ghuri cement plant. Other raw materials for cement, such as clay and gypsum, occurred in the Provinces of Baghlan (the Surkhab clay deposit and the Dodkash gypsum deposit) and Parvan. Consumption of gypsum for use in cement and plaster manufacture was projected to increase to 100,000 metric tons per year (t/yr) from 25,000 t/yr during the next 2 years (Industrial Minerals, 2008).

Mineral Fuels

India joined the Turkmenistan-Afghanistan-Pakistan-India (TAPI) natural gas pipeline project in April 2008; the pipeline would carry natural gas 1,800 kilometers from Central Asia to India. The Asia Development Bank, the Governments of the four participating countries, and the United States had emerged as supporters of the project since 2001. In addition to an estimated cost for the project of $7.6 billion, there remained the question of whether Turkmenistan had enough natural gas to fill the pipeline. Turkmenistan's Dauketabad Field could supply 3 billion cubic meters per year of natural gas but the field was not expected to come onstream until 2018. Turkmenistan had existing supply agreements with China and Russia and planned to resume sales to Iran and to send natural gas to Europe through a trans-Caspian pipeline. India's interest in joining the TAPI project was in opening exploration and development opportunities for Turkmenistan's gas reserves in addition to receiving gas from Turkmenistan. Afghanistan would be a beneficiary of India's participation in the pipeline and the gas production in Turkmenistan (Petroleum Economist, 2008).

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TABLE 1

AFGHANISTAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity^e
Aluminum:			
Extrusion and powder coating	Qader Najib Ltd.	Kabul	NA
Manufacture	Salam Bilal Ltd.	Kandahar	360
Steel, manufacture	Khalil Najeeb Steel Mills Ltd.	Jalalabad, Kabul, and Mazar-i-Sharif	36,000

^{e}Estimated; estimated data are rounded to no more than three significant digits. NA Not available.

THE MINERAL INDUSTRY OF AUSTRALIA

By Pui-Kwan Tse

Australia was one of the world's leading mineral producing countries and ranked among the top 10 countries in the world in the production of bauxite, coal, cobalt, copper, gem and near-gem diamond, gold, iron ore, lithium, manganese ore, tantalum, and uranium. Since mid-2008, the global financial crisis had sharply weakened world economic activities, and the slowdown had been particularly pronounced in the developed countries in the West. Emerging Asian economies were also adversely affected by the sharply weaker demand for exports and tighter credit conditions. After a period of strong expansion, Australia's economic growth decreased by 0.5% in the final quarter of 2008. Overall, Australia's economy grew at a rate of 2.4% during 2008. During the past several years, owing to anticipated higher prices of mineral commodities in the world markets, Australia's mineral commodity output capacities expanded rapidly. As a result of the slowdown in demand for such commodities as iron ore, nickel, and zinc in the world, surplus productive capacity was expected and export earnings for Australia's energy and mineral commodities were expected to decline during the next couple of years (Australian Bureau of Agricultural and Resources Economics, 2009c, p. 13; Reserve Bank of Australia, 2009, p. 31).

Australia's total mineral exploration spending, excluding that of the petroleum sector, was US$2,000.9 million (A$2,223 million) in fiscal year 2008-09, which was a decline of 9.7% from that of fiscal year 2007-08 (the Australian fiscal year runs from July 1 to June 30). The decline in exploration spending was the result of decreases in spending for base metals, gold, and uranium. Exploration spending for coal, iron ore, and other commodities, such as manganese, molybdenum, phosphate rock, and tungsten, increased. The Northern Territory was the only Australian State or Territory that recorded an increase in exploration spending. Spending on coal exploration in New South Wales and Queensland increased but spending on other commodities decreased. Western Australia remained the leading destination for exploration spending and accounted for about 56% of the total exploration expenditure followed by Queensland, 16%; South Australia, 10%; New South Wales, 8%; and others, 10%. Total Australian petroleum exploration (onshore and offshore) spending was US$3.4 billion (A$3.8 billion) in fiscal year 2008-09, which was an increase of 26% from that of fiscal year 2007-08. About 66% of the country's total exploration expenditure was spent on existing deposits and the remaining 34% was spent on new exploration (Australian Bureau of Agricultural and Resource Economics, 2009d; Department of Mines and Petroleum, 2009b, p. 4).

As a result of the spending on exploration, significant mineral resources were discovered. These included the Henry George zinc deposit at Broken Hill in New South Wales, the Hillside copper deposit on the Yorke Peninsula in South Australia, the Prairie Downs zinc deposit at Newman in Western Australia, the Reedy Creek gold deposit near Melbourne in Victoria, the Bungalow mangnetite deposit near Cowell in South Australia, and the Brockman iron project in the Pilbara region of Western Australia (Australian Bureau of Agricultural and Resource Economics, 2009a).

Minerals in the National Economy

Australia's mining sector contributed more than $105 billion to the country's gross domestic product (GDP), or 7.7% of the GDP during fiscal year 2007-08. In 2008, the mining sector employed 173,900 people who worked directly in mining and an additional 200,000 who were involved in supporting the mining activities. Expectations of sustained levels of global demand for minerals led to increased production of minerals and metals in Australia, and the mineral industry was expected to continue to be a major contributor to the Australian economy in the next several years (Australian Bureau of Statistics, 2009b).

Government Policies and Programs

The powers of Australia's Commonwealth Government are defined in the Australian Constitution; powers not defined in the Constitution belong to the States and Territories. All powers that relate to mineral resources and their production belong to the States and Territories. Except for the Australian Capital Territory (that is, the capital city Canberra and its environs), all Australian States and Territories have identified mineral resources and established mineral industries. The Australian Government sets a company tax rate of 30% on profit and a 10% tax on goods and services. Royalties for metals are levied as a percentage of the sale value—concentrates, 5%; uranium, 5%; and pure metals, 2.5%. The royalty paid by a company is allowed to be deducted from reported income for income tax purposes. The amount of royalty paid can be reduced by deducting the costs incurred in the transportation of the mineral ore concentrate or metal (Department of Mines and Petroleum, 2009a).

In 2008, owing to the global financial crisis, Australia's manufacturing activity declined for 6 consecutive months as companies reduced production. The Federal Government announced that it would fund a A$42 billion nation-building and jobs plan in 2009 to strengthen employment and economic growth in the country. The Reserve Bank of Australia lowered the official interest rate to 3.25% in early 2009, which was a 400 percentage point reduction since September 2008. The Western Australian government announced an A$80 million exploration incentive package to encourage exploration in underexplored Greenfield regions of the State (Department of Mines and Petroleum, 2009b, p. 5).

The Australian Government permits uranium mining, provided that all the relevant environmental safeguards and health requirements are met. Regulation of Australia's uranium mines is mainly a State and Territorial government responsibility. Uranium mining had been permitted only in the Northern Territory and South Australia but in 2008, the Western

Australia government lifted an 8-year ban on uranium mining (Australian, The, 2008).

Production

Australia continued to be one of the world's leading producers of such commodities as bauxite, coal, cobalt, copper, gem and near-gem diamond, gold, iron ore, lithium, manganese ore, tantalum, and uranium. The country's refined metal production capacity was moderate compared with that of China and Japan in the Asia and the Pacific region. Because of its large mineral resources, Australia was virtually self-sufficient in most mineral commodities. Petroleum production, however, met only about 70% of the country's consumption. Australia was one of the leading exporting countries for alumina, coal, iron ore, and uranium in the world. In 2008, production of such commodities as refined copper, iron ore, lead metal, lithium and tantalum increased significantly. An increase of refined copper output was a result of the startup of the Lady Annie solvent extraction and electrowinning operation and increased output from the Townsville refinery and the Olympic Dam operation. The commissioning of the BHP Billiton Ltd., Fortescue Metals Group Ltd., and Rio Tinto Ltd.'s iron ore operations contributed to an increase in iron ore production. The increase in lead production was from the Mount Isa smelter. Production of chromate, diamond, mined gold, nickel metal, ilmenite, magnesite, and mined and refined tin decreased significantly. The rebuilding of the Kalgoorlie nickel smelter and the reduced availability of gas associated with the Varanus Island gas explosion caused the decrease of intermediate nickel output. The decrease in mined tin and tin metal production was caused by the shutdown of the Collingwood tin mine and smelter (table 1).

Structure of the Mineral Industry

The Australian mineral industry is characterized by free enterprise in which private companies are involved in exploration, mine development, mineral production, mineral processing, and marketing. A number of Australian mineral companies were affiliates or subsidiaries of European and U.S. companies, which controlled a large part of the mining, smelting, and refining sectors and a significant portion of the mineral fuels sector (table 2).

Ownership of the mineral rights in Australia generally are vested in the government of the relevant State or Territory or the Commonwealth Government for Federal lands and waters, regardless of ownership or tenure of the surface area. Mineral ownership is divided between State ownership in the State onshore areas and Commonwealth ownership in the Territories and in offshore areas beyond Australia's 4.8-kilometer (km) territorial limit. Each State and Territory government administers the mineral industries within its own borders, which includes registering land titles; issuing exploration and development permits; conducting inspections and assuring compliance with health, safety, and environmental regulations; and levying royalties and taxes. Because the Commonwealth may restrict mineral exports for the good of the country, however, it effectively has control over most mineral production.

Mineral Trade

Australia continued to rely heavily on exports of the majority of its mineral production to sustain the country's mineral industry development. In 2008, the value of Australia's total foreign trade was $408.4 billion (A$453.8 billion), of which the value of exports was $202.2 billion (A$224.7 billion) and the value of imports was $206.2 billion (A$229.1 billion). Mineral and metal exports accounted for about 60.0% of the total value of exports. Export volumes that were higher than in 2007 included alumina, thermal coal, and iron ore. The value of coal exports accounted for 31% of the total mineral and metal value followed by iron ore, 20%; gold, 10%; oil, 7%; and liquefied natural gas, 6%. Australia's mineral and metal exports went mostly to Asian countries. Australia remained the world's leading exporter of alumina, coal, diamond (gem, near-gem, and natural industrial), ilmenite, iron ore, mined lead, rutile, and zircon. Crude petroleum and its refined products remained Australia's leading imported mineral and fuel commodity, followed by gold, iron and steel, potassium fertilizer, and silver (Australian Bureau of Statistics, 2009a).

Commodity Review

Metals

Aluminum.—Australia was the leading bauxite producing country in the world. Bauxite came from the Gove Mine in the Northern Territory; the Weipa Mine in the northern part of Queensland; and the Huntly, the Willowdale, and the Worsley Mines in Western Australia. Australia was also the leading alumina producing country in the world. All Australia's alumina refineries were located in close proximity to their bauxite mines and shipping facilities. Western Australia accounted for 63% of the country's alumina output. China remained the leading destination for exported Australian alumina, which accounted for about 21% of the total exported volume followed by Bahrain, South Africa, and the United Arab Emirates, 14% each; Mozambique, 10%; and other countries, less than 10% each. Aluminum refineries in Western Australia produced about two-thirds of the country's total output. The consumption of domestic aluminum smelters was less than 20% of the country's total alumina output, and the remainder was exported. In 2008, Australia exported 1.68 million metric tons (Mt) of aluminum. Japan was the leading destination of Australian aluminum exports and accounted for 38% of the total, followed by the Republic of Korea, 14%; Thailand, 13%; Taiwan, 11%; and Malaysia, 7%; the remainder went to other countries in the world (Australian Bureau of Agricultural and Resource Economics, 2009e, p. 16).

Owing to increasing demand for alumina in recent years, Australian producers planned to expand their bauxite mines' and refineries' output capacity. Bauxite Resources Ltd. announced that the company was granted a mining license to develop the bauxite deposit at Bindoon in the

Darling Range, Western Australia. The company was waiting for approval from the Government to develop the bauxite deposit at Avon, which is located south of Bindoon. The Avon and the Bindoon deposits hosted inferred resources of 18.2 Mt of gibbsite ore at average grades of 43.1% aluminum oxide and 3.2% silicon oxide. The company planned to start open pit mine construction in mid-2009 and to complete the construction in mid-2010. The initial production rate was designed to be 1 million metric tons per year (Mt/yr), which would be increased to 3 Mt/yr in later years. The Australian Government approved China's Shandong Provincial Bureau of Geology and Resources' acquisition of a 15% share of Bauxite Resources. Most of the company's bauxite output would be destined for China, mainly Shandong Province. During the past several years, China had expanded its alumina refinery output capacity. Owing to a shortage of bauxite resources within China, the country's demand for bauxite imports increased. Chinese refineries were seeking reliable, long-term bauxite suppliers in politically secure countries. Australia is geographically close to China and is the leading destination for China's mineral investors. Bauxite Resources also signed a memorandum of understanding with China's Yankuang Group Corp. to build jointly an alumina refinery in Western Australia (Bauxite Resources Ltd., 2009, p. 9-20).

Aluminum Corp. of China Ltd. through its subsidiary CHALCO Australia planned to develop the Aurukun bauxite resource project, which is located 10 km northeast of Aurukun and 50 km south of Weipa in the Western Cape Region of Queensland. The company planned to mine 10 Mt/yr of bauxite ore and to produce 6.5 Mt/yr of beneficiated ore with an average aluminum oxide content of 65%. The project also included a plan to build a 2.1-Mt/yr-capacity alumina refinery and associated facilities at Abbot Point, which is located northwest of Bowen, Queensland. The beneficiated ore was expected to be transported by an overland conveyor to the port facility, which is located about 1.5 km south of Boyd Point. A feasibility study and an environmental impact study were underway. The decision on whether to proceed with the mine and refinery was expected to be made at the end of 2009; however, CHALCO decided to delay the decision to build the refinery at Abbot Point because of the uncertainty of the alumina market. In 2004, CHALCO was awarded a permit to mine the bauxite deposit at Aurukun on the condition that the company would also build a refinery in the area (CHALCO Australia, 2009).

Owing to the decline of external demand, Rio Tinto Alcan decided to defer some capital expenditures in 2009; however, the company continued to commit capital to certain high-priority projects. The company planned to invest $30 million in a feasibility study to develop a new bauxite operation to the south of the existing Weipa bauxite mine and port. If approved, Weipa's total bauxite production capacity would increase to 35 Mt/yr from 21 Mt/yr in 2008. The construction of the mine would take 3 years to complete. The expansion of the Yarwun alumina refinery was underway in 2008, and the cost was estimated to be about $1.8 billion. The production capacity would increase to 3.4 Mt/yr in 2011. The equipment at the new Yarwun plant was designed to reduce the refinery's greenhouse gas emissions. Flue gas desulfurization equipment would be installed at the coal-fired boiler to reduce the site's total sulfur dioxide emissions. Carbon dioxide emissions per metric ton of alumina would be reduced by 35% (Rio Tinto plc, 2009a, p. 40).

In 2008, the board of directors of BHP Billiton approved a proposal to expand the Worsley alumina refinery to 4.6 Mt/yr from 3.5 Mt/yr. The expansion project would include the expansion of the bauxite mining operation at Boddington and the upgrade of the port facility. The project was budgeted at $1.9 billion and was scheduled to be completed in the first half of 2011 (BHP Billiton Ltd., 2009a, p. 27).

Cape Alumina Ltd. held 100% interest in 2,400 square kilometers (km^2) of leased land outside of Rio Tinto Alcan's Weipa deposit. The company had invested more than $8 million to explore the leased area and discovered 130 Mt of bauxite resources at an average washed grade of 53.1% Al_2O_3 and 12.4% SiO_2 at Pisolite Hills, which is located 50 km northeast of Weipa on the western part of Cape York Peninsula. The company completed a feasibility study and prepared a bankable feasibility study and an environmental impact statement for the Pisolite Hills project. The project would involve the development of a greenfield bauxite mine that would produce between 8 and 12 Mt/yr of run-of-mine bauxite ore. The mined ore would be crushed and washed. As a result of beneficiation, about 7 Mt/yr of washed bauxite would be exported. The bankable feasibility study was planned to be completed in 2010, and production was expected to begin in 2013. Major shareholders of the company included Bondline Ltd. of Cyprus, Chiping Xinfa Huayu Alumina Co. Ltd. of China, Metallica Minerals Ltd. of Australia, and Resource Capital Funds of the United States. Xinfa had signed a 5-year, 1-Mt/yr bauxite offtake agreement with Cape Alumina (Cape Alumina Ltd., 2009, p. 10).

Antimony.—In 2007, Straits Resources Ltd. decided to redevelop the historic Hillgrove antimony and gold mine near Armidale in New South Wales. The construction of a demonstration processing plant started in 2007 and was completed in the first half of 2008. The designed output capacity was for 10,000 metric tons per year (t/yr) of antimony, 30 metric tons (t) of tungsten, and 622 kilograms (20,000 troy ounces) of gold. The mine contained recoverable resources of 40,000 t of antimony, 100 t of tungsten, and 6.9 t (222,000 troy ounces) of gold. In 2008, the company produced 222 t of antimony. Production, however, was hampered by a number of technical problems, including process water treatment management and the interface between the leaching and electrowinning sections of the plant. The operation was unable to meet its production target. The company planned to suspend plant operations temporarily to resolve technical issues at the plant. The development of an underground mine and exploration at the mine site area continued during the suspension period (Straits Resources Ltd., 2009, p. 33).

Cobalt and Nickel.—Australia's main nickel ores were primary sulfides of nickel, which occur as lodes within mafic and ultramafic (iron- and magnesium-rich) igneous rocks that have a volcanic and subvolcanic origin. Western Australia's mined nickel output accounted for more than 90% of the country's total output. The top five nickel producers accounted for 80% of the total sales. BHP Billiton's Nickel West was Australia's leading nickel operation. Nickel West included the Leinster and the Mount Keith mines. A number of smaller sulfide nickel operations were operated by Mincor Resources NL and Xstrata Nickel Australia Pty Ltd. (a subsidiary of Xstrata plc). As a result of a rapid decline in world nickel prices during the second half of 2008, a number of Australian nickel producers reduced output or placed their mines on care-and-maintenance status during the fourth quarter. Most cuts in production took place at smaller operations that produced less than 6,000 t/yr of nickel in ore and concentrates. These mines included Fox Resources Ltd.'s Radio Hill Mine; OZ Minerals Ltd.'s Avebury Mine; Palmary Enterprises Ltd.'s Kambalda Mine; and Norilsk Nickel Mining and Metallurgical Co.'s Cawse, Silver Swan, and Waterloo Mines. Australia's mined nickel output was expected to decrease during the next 2 years but to begin to recover slowly starting in 2011. In 2008, Australia exported 209,000 t of nickel in concentrates, intermediate products, or metal (Australian Bureau of Agricultural and Resource Economics, 2009b, p. 193).

Barra Resources Ltd. announced that its joint venture project with Fission Energy Ltd.—the Mount Thirsty cobalt-nickel-manganese deposit—could have the potential to make the company one of the leading cobalt producers in the region. The deposit is located 20 km north-northwest of Norseman in Western Australia. The deposit contains resources of 29 Mt at grades of 0.88% manganese, 0.56% nickel, and 0.14% cobalt in an area 1.3-km long and 800-meters (m) wide. A majority of high-grade oxide ore was located close to the surface within 8 to 19 m. An engineering and metallurgical study found that the acid-leaching recovery rate was 99% cobalt, 98% manganese, and 78% nickel, and the operating cost was about A$100 per metric ton of ore. The Mount Thirsty deposit had the potential to support a throughput of 2 Mt/yr of ore to produce 27,000 t of manganese, 10,300 t of nickel, and 3,700 t of cobalt. The company used electromagnetic survey technology to detect any potential nickel sulfide at depth. The feasibility study would be carried out in 2009 (Barra Resources Ltd., 2009).

Western Areas NL's Forrestania nickel project is located 400 km east of Perth, Western Australia. More than 25 nickel occurrences had been identified. The first developed mine of the project was the Flying Fox underground nickel mine, which is located about 108 km south of Marvel Loch. The Flying Fox consisted of a number of zones of mineralization, labeled from T zero extending vertically down to the T7 zone to a depth of 820 m below the surface. The operation activity was concentrated at the T1 and T2 ore bodies during the first year of operation. The mine was estimated to have probable ore reserves of 3.6 Mt at a grade of 3.0% nickel and an inferred resource of 1.9 Mt at a grade of 4.7% nickel. The ore was carted to and processed at the Lake Johnson concentrator, which was operated by Norilsk Nickel. Western Areas' Cosmic Boy concentrator was scheduled to begin operating in 2009, and all ore from the Flying Fox Mine would be carted to the Cosmic Boy mill. Western Areas signed a contract with BHP Billiton to sell up to 10,000 t/yr of nickel in concentrates to a total of 75,000 t nickel from the Forrestania nickel project. As a part of the offtake agreement, BHP Billiton would provide A$45 million in financing to Western Areas, which would be used for the development of the Spotted Quoll deposit and a plant expansion. The Spotted Quoll deposit is located 114 km south of Marvel Loch and is part of the Forrestania nickel project. Spotted Quoll had mineral resources of about 2 Mt at an average grade of 6.2% nickel. Western Areas was targeting to produce between 20,000 and 25,000 t of nickel from the Flying Fox and the Spotted Quoll Mines beginning in 2010. Western Areas planned to upgrade the Cosmic Boy concentrator to 550,000 t in 2010 from 300,000 t. Western Areas also signed an offtake contract with China's Jinchuan Group Ltd. to supply up to 25,000 t of nickel in concentrates in 2010 and 2011. The balance of the company's nickel output that was not sold to BHP Billiton during 2010 and 2011 would be sold to Jinchuan (Western Areas NL, 2009, p. 8-24).

BHP Billiton was an integrated Australian nickel company that operated mines, concentrators, a smelter, and a refinery. The company's Kambalda nickel concentrator is located 60 km south of Kalgoorlie and produced between 35,000 t and 40,000 t of nickel in concentrates from raw materials supplied by third-parties. Concentrates from the Kambalda concentrator contained about 13% nickel. Concentrates from BHP Billiton's Nickel West operations and Kambalda operation were shipped to the Kalgoorlie smelter in Kalgoorlie to produce nickel matte, which contained about 68% nickel, 2% to 3% copper, and 1% cobalt; the smelter had an output capacity of 110,000 t/yr of nickel matte. In 2008, BHP Billiton exported about 31% of its nickel matte output. The remaining nickel matte was railed to the Kwinana refinery. The refinery had an output capacity of about 67,000 t/yr of nickel metal, which contained 99.8% nickel. In June, the company shut down its smelter and refinery for 3 months to rebuild it furnaces. As a result, the outputs of nickel from the Nickel West operation and the Yabulu refinery were lower in 2008 than in 2007. Owing to the decrease of nickel demand in the world market, BHP Billition decided to shut down its newly commenced Ravensthorpe operation. The Yabulu refinery would cease processing mixed nickel cobalt hydroxide product from Ravensthorpe (BHP Billiton Ltd., 2009c).

Copper.—Australia's copper resources occur largely at Olympic Dam in South Australia and at Mount Isa in Queensland. Other important copper resources are located at the CSA and the Northparkes deposits in New South Wales; the Ernest Henry, the Mammoth, and the Osborne deposits in Queensland; and the Golden Grove and the Nifty deposits in Western Australia. Australia's mined copper output ranked it among the top five producers in the world, which also included China, Chile, Peru, and the United States. In 2008, Australia's copper mine production remained relatively unchanged. Queensland continued to be the leading State for mined copper production, largely from the Mount Isa region, which accounted for 44% of the country's output. South Australia's output accounted for 22% of the total (all produced from the Olympic Dam Mine) and New South Wales's output accounted for 16% (largely from the Cadia-Ridgeway, the Northparkes, and the Tritton Mines). Western Australia's mined copper increased by 7% compared with that of 2007 and accounted for 14% of the country's total output, mainly from the Golden Grove and the Nifty Mines. Tasmania's mined copper output was mainly from Mount Lyell. In 2008, Australia exported a total of 1.8 Mt of copper concentrates, which was an increase of 20% from that of 2007, to such countries as China, India, Japan, and the Republic of Korea (Australian Bureau of Agricultural and Resource Economics, 2009e, p. 19).

Owing to lower copper prices and to difficulties in securing financing, especially during the second-half of 2008, a number of copper mines were placed on care-and-maintenance status in late 2008, including the Browns Oxide, the Eloise, the Lady Annie, the Leichardt, and the Mount Gorden Mines. Australia's mined copper production was expected to increase during the next 2 years because a number of new projects—the Boddington, the Cloncurry, the Copper Hill, the Einasleigh, the Kanmantoo, the Mutooroo, the Prominent Hill, the Ridgeway Deeps, and the Rosebery—would be commissioned, and recently commenced projects would approach full capacity. With additional new capacity and the reopening of some mines closed in 2008, Australia's mined copper output was expected to grow at an annual rate of 5% to 1.2 Mt in 2014 (Australian Bureau of Agricultural and Resource Economics, 2009f).

CopperCo Ltd.'s Lady Annie copper deposit is located 100 km north-northwest of Mount Isa, Queensland. The company completed construction of the mine and started production in 2007. The copper oxide ore was located near the surface and has copper resources of about 11.3 Mt at an average grade of 1.0% copper. The ore was processed through a solvent extraction and electrowinning process on site. Full copper production of 19,000 t/yr of copper cathode was expected to be achieved in early 2008. A project to expand the output capacity to 30,000 t/yr was scheduled to begin in 2008 and to be completed in 2009. Owing to lower prices of copper, financial difficulties, and heavy rainfall in December 2008 that had a significant effect on production, the company decided to suspend the mine's operations. CopperCo decided to sell the Lady Annie operation and other assets to other investors. Cape Lambert Iron Ore Ltd. and Xstrata plc were potential buyers (Delotte Touche Tohmatsu, 2009).

The Northparkes Mine, which was a joint venture between Rio Tinto Ltd. and Sumitomo Group, is located in Central West, New South Wales. In 2006, the joint-venture partners approved the development of the E48 Block project to extend the mine's life to 2024. In 2008, copper production was about 18,000 t less than in 2007 because of the shutdown of the E26 Lift 2 Block for extension construction. The construction was completed in mid-2008. The company completed 75% of the E48 project at the end of 2008. Owing to the global financial crisis, Rio Tinto suspended the construction the E48 project in January 2009 (Rio Tinto Ltd., 2009).

OZ Minerals completed the construction of its Prominent Hill copper-gold mine in 2008 and was scheduled to put it into operation in February 2009. The open pit mine was designed to produce between 85,000 and 100,000 t/yr of contained copper and between 1.87 t (60,000 troy ounces) and 2.18 t (70,000 troy ounces) per year of gold in concentrates. The mine contained total (proven and probable) resources of 75.7 Mt of ore at an average grade of 1.19% copper, 3.01 grams per metric ton (g/t) silver, and 0.59 g/t gold. Concentrates would be transported by the Adelaide-Darwin railway to the Port of Darwin and exported to customers in China and India. Owing to lower metal prices in the world and the global financial crisis, OZ Minerals decided to refinance or sell off part of its facilities in mid-2008. OZ Minerals entered an agreement with China Minmetals Nonferrous Metals Co. to acquire all outstanding shares in OZ Minerals, including Prominent Hill. Owing to concerns about Australia's national security interests, the Australia Government did not approve the transaction because Prominent Hill is located in the Woomera prohibited weapons testing area. OZ Minerals and Minmetals agreed to exclude Prominent Hill in their agreement. OZ Minerals would sell all its assets other than the Prominent Hill to Minmetals for $1.2 billion (OZ Minerals Ltd., 2009, p. 11).

The bankable feasibility study of the Copper Strike Ltd.'s Einasleigh project, which is located about 70 km southeast of Georgetown, Queensland, was completed. The company's plan for the development of this project was based on the Einasleigh underground copper deposit and the Kaiser Bill open-cut copper deposit followed by open cuts from the lead, silver, and zinc deposits at Chloe and Jackson, which are located to the south of the Einasleigh and the Kaiser Bill copper deposits. The company planned to have open-cut production from Kaiser Bill at a rate of between 0.8 and 1.6 Mt/yr of copper ore in 2010 and to mine about 80,000 t/yr of copper ore from the high-grade Einasleigh deposit in 2011. Indicated and inferred resources at Einasleigh were 825,000 t at grades of 3% copper, 0.17 g/t gold, and 14 g/t silver; those for Kaiser Bill were 13.4 Mt at grades of 0.83% copper, 0.13 g/t gold, and 7 g/t silver. The design capacity of the processing plant at Kaiser Bill was 15,000 t/yr of copper concentrates. The concentrates would be shipped to Townsville, which was located about 300 km from the plant, for export. A full environmental management plan for the Kaiser Bill mining lease application was submitted to the Department of Environment and Resource Management and was awaiting Government approval. This was a major step in the granting process of the Kaiser Bill mining lease (Copper Strike Ltd., 2009, p. 5).

Havilah Resources NL completed the drilling feasibility study of its Kalkaroo copper and gold deposit, which is located about 91 km northwest of Broken Hill, South Australia. In 2007, Glencore International AG of Switzerland funded a $14 million feasibility study of the Kalkaroo project. Upon completion of the feasibility study, Glencore could elect to arrange project financing for the subsequent mining joint venture in exchange for a 14% participating interest and metal offtake. The feasibility study indicated that the Kalkaroo deposit had measured resources of 62 Mt at grades of 0.55% copper, 0.44 g/t gold, and 615 parts per million molybdenum. The feasibility study would incorporate with an economic model based on the optimum open pit mine design to produce 30,000 t of contained copper concentrates using current estimates of capital and operating costs in 2009 (Havilah Resources NL, 2009).

Gold.—Australia's gold mine output ranked fourth in the world after China, the United States, and South Africa. In 2008, Australia's mined gold output decreased by more than 10% from that of 2007. Western Australia remained the leading gold-producing State with a 62.3% share, followed by New South Wales, 14.4%; Queensland, 8.4%; Northern Territory, 7.0%; South Australia, 3.3%; and Tasmania and Victoria, 2.3%

each. The country's gold resources occur and are mined in all States, as well as in the Northern Territory, and much of the gold was produced from large open pit mines. Owing to higher prices of gold in the world markets, gold operators could afford to reduce the grade of ore fed into their processing plants in order to extend the mine life. Australia's gold production was expected to be higher during the next several years because a number of new projects were expected to increase production as they approached their full production potential, which was expected to offset the projected production declines at numerous mines that were nearing the end of their estimated mine life. In 2008, Australia exported 415 t of refined gold produced from imports of gold doré and scrap that were shipped from overseas, refined into gold bullion, and then reexported. India remained Australia's top gold export destination, accounting for 38% of total exports, followed by the United Kingdom, 35%; the United Arab Emirates, 11%; Thailand, 9%; and others, 7%. India was the leading gold consuming country in the world. London was a gold market trading center and many of Australia's gold transactions were being conducted in London (Australian Bureau of Agricultural and Resources Economics, 2009e, p. 21).

In 2004, Avoca Resources Ltd. acquired the Higginsville project from Gold Fields Ltd. and discovered the Trident deposit. The Higginsville Mine was in operation in the 1990s. The Higginsville Mine is located near Higginsville, which is 45 km north of Norseman, Western Australia. In 2007, Avoca Resources decided to build a new underground mine at Higginsville and purchased the neighboring Chalice deposit from Chalice Gold Mines Ltd. In 2008, the Higginsville project had a resource of 12.25 Mt at a grade of 3.7 g/t gold at the Trident deposit. In 2008, the company completed the construction of a 1-Mt/yr treatment plant and a 100-megawatt powerplant. Gold production at the mine began in 2008. Avoca Resources also acquired Two Boys Mine, which is located 1.5 km south of the Poseidon South pit, which was mined out (Avoca Resources Ltd., 2009, p. 6).

After 3 years in development, St. Barbara Ltd. commissioned its Gwalia underground mine, which is located 3 km south of Leonora, Western Australia, in 2008. The refurbished processing plant had a nominal capacity of 1.2 Mt/yr, which could be expanded to 1.8 Mt/yr. Initial production was about 2.6 t (83,000 troy ounces) in 2009 and would be increased to about 6.5 t (210,000 troy ounces) in 2012. The mine had resources of more than 7 Mt of ore grading 9 g/t gold. The company planned to develop the Tower Hill deposit, which is located 2 km from the Gwalia plant, in 2010. The Tower Hill deposit had reserves of 2.5 Mt at a grade of 4.6 g/t gold. The company continued exploring the Gwalia area and expected to discover more resources to extend the Leonora operation. St. Barbara's Southern Cross operation is located 30 km south of Southern Cross, Western Australia. The Marvel Loch processing plant had the capacity to process 2.4 Mt/yr of ore. Owing to low ore grades and a decrease in the demand for gold, the company decided to shut down all open pit operations at South Cross. The Marvel Loch underground mine was the only source of ore for the processing plant. As a result, the processing plant was operating on a biweekly basis (St. Barbara Ltd., 2009, p. 6-10).

In 2002, Newcrest Mining Ltd. commenced the Ridgeway gold-copper underground mining operation. The mine had resources of 152 Mt at grades of 0.77 g/t gold and 0.39% copper. The processing plant had a throughput capacity of 5.6 Mt/yr of ore. After 2 years of study, the company had decided to expand the development of the resource below the current Ridgeway Mine of approximately 300 m to about 1,100 m below the surface in 2007. The Ridgeway Deeps project was based on the construction of a block cave underneath the existing Ridgeway sublevel cave. After completion, it would be the deepest block cave in Australia, and the process of constructing it would provide valuable experience for the Australian mining industry as it explores and develops deeper mineral resources in the country. The operation was expected to produce 50 t/yr (1.6 million troy ounces per year) of gold and 210,000 t/yr of copper for 8 years. The commencement of Ridgeway Deeps was scheduled for 2010. The total capital cost for the construction of the mine was A$545 million (US$490 million). Continued exploration drilling indicated that a continuation of the ore body was present below the area designated for the Ridgeway Deeps block cave. The company was exploring development of a second block cave that could further extend the mine life of the Ridgeway Deeps (Newcrest Mining Ltd., 2009, p. 14-15).

Iron and Steel.—Australia was among the top three iron ore producers (in terms of iron content) in the world, along with Brazil and China. Australia's most significant iron ore mines are located in the Pilbara region of Western Australia, which accounts for 96.7% of the country's total iron ore production followed by South Australia, 2.3%; Tasmania, 0.7%; and Northern Territory, 0.3%. Owing to its limited iron and steel output capacity, Australia exported about 90% of its iron ore output to such Asian countries as China, Japan, the Republic of Korea, and Taiwan. China received 59.2% of Australia's iron ore exports followed by Japan, 24.8%; the Republic of Korea, 10.8%; Taiwan, 3.2%; European Union countries, 1.9%; and others, 0.1%. Increased demand for iron ore in Asian countries, especially China, stimulated substantial investment in new iron ore projects in Australia and other iron-ore-rich countries. Mines operated by BHP Billiton and Rio Tinto dominated the Pilbara area's output. In 2008, Australia's iron ore and pellet exports increased to 309 Mt from 267 Mt in 2007. China was the world's leading iron ore importing country and accounted for about 50% of the world iron ore trade. China's iron and steel industry was expected to continue to grow during the next several years. Because China had only a limited domestic supply of high-grade iron ore, China's iron and steel producers increasingly relied on imported iron ore to meet their demand. Australia's iron ore and pellet exports were expected to continue to increase to 349 Mt in 2010 and 395 Mt in 2011 (Australian Bureau of Agricultural and Resource Economics, 2009b, p. 173; 2009e, p. 22).

China was the leading iron ore consumer in the world. To sustain the development of its iron and steel industry, China's iron and steel producers looked for investment in countries that had rich iron ore resources. Australia had significant iron ore resources and accounted for $4.7 billion in mineral and exploration and development, or more than 50% of China's total investment in the Asia and the Pacific region during fiscal year 2007-08. In 2008, the Australian Government approved Sinosteel Corp.'s acquisition of up to 49.9% of Murchison Metals, Aluminum Corp. of China Ltd.'s acquisition of up to a 14.99% share in Rio Tinto plc, and West Mining Co. Ltd.'s acquisition of a 10% share of FerrAus Resources Ltd. Other iron ore producer acquisitions by Chinese companies that were expected to be approved by the Australian Government included Anshan Iron and Steel Corp.'s investment in Gindalbie Metals Ltd.; Baotou Iron and Steel Group and Wuhan Iron and Steel (Group) Corp.'s investment in Centrex Metals Ltd.; Baosteel Group's investment in Auilia Resources Ltd.; China Railway Materials Corp.'s investment in FerrAus Resources; and Hunan Valin Iron and Steel Group's investment in Fortescue Metals Group and Golden West Resources Ltd. (Ministry of Treasury, 2008a, b; 2009).

The Pilbara region was the leading iron-ore-producing center in Australia. Besides BHP Billiton and Rio Tinto, many junior companies began iron ore operations in the region during the past 2 years. They had been hampered by uncertainty on how they would transport ore to export terminals because of the lack of rail service to Port Hedland. The Pilbara region's railways were operated mainly by BHP Billiton and Rio Tinto. Australian courts ruled that BHP Billiton and Rio Tinto must haul ore mined by other companies in the Pilbara region if and when they had spare rail capacity. BHP Billiton and Rio Tinto planned to expand their iron ore output capacity in the region and both companies fought against the idea of transporting other companies' iron ore through their railway system. Domestic analysts projected that the volume of exports from the Pilbara iron ore ports in northwestern Australia would reach 890 Mt by 2025 and could exceed the capacities of existing ports at Cape Lambert, Dampier, and Port Hedland. Iron ore producers urged the government of Western Australia to develop a plan to solve the congestion problems, such as a new railway system and a new port in northwestern Australia (Creamer Media (Pty) Ltd., 2009a).

BHP Billiton had seven iron ore mining operations and port facilities in the Pilbara region of Western Australia. Iron ore production in the Mount Newman area was mainly from the Mount Whaleback ore body, which was equipped with primary crushing plants and an 8-Mt/yr beneficiation plant. The Yandi area had two processing plants and a primary crusher and overload conveyor to crush and screen ore. The facility had the capacity to handle more than 42 Mt/yr of ore. The Jimblebar area had primary and secondary plants, and crushed ore was blended with ore produced from Mount Whaleback to create the Mount Newman blend. The Mount Goldsworthy open cut mine included the Area C, the Nimingarra, and the Yarrie deposits. The Nimingara and the Yarrie were equipped with primary crushers and Area C had an ore processing plant, a primary crusher, and a conveyor to handle more than 42 Mt/yr of ore. BHP Billiton's Rapid Growth project (RGP), which was set up in 2003, was a multiphase expansion project designed to help handle the increased demand for iron ore in the world. The RGP was expected to increase the company's iron ore handing capacity to 165 Mt/yr through the development of four new port berths. RGP 1 was completed in 2004 and RGP 2 was completed in 2006; as a result, the port's handling capacity was increased to 118 Mt/yr. The RGP 3's mine rail and port expansion, which was projected to cost $1.3 billion, was completed in 2008; the expansion was expected to increase the port's handling capacity to 129 Mt/yr. The Area C iron ore mine output capacity would be increased by 20 Mt/yr to 42 Mt/yr. In March 2007, BHP Billiton approved $1.85 billion in funding for RGP 4, which would be focused on expanding the Newman iron ore operation. The expansion was expected to increase capacity to 155 Mt/yr by early 2010. The company also approved $4.8 billion for the final stage RGP 5, including the construction of new lump rescreening plants at Nelson Port and Finucane Island, which would increase the port's total handling capacity to 165 Mt/yr in 2008. The expansion work would include the addition of two new berths and shiploading facilities at Harriet Point. It would also increase the rail capacity to 300 Mt/yr between the Yandi Mine and Port Hedland (BHP Billiton Ltd., 2009a, p. 39; 2009b).

The third ranked iron ore producer, Fortescue Metals Group Ltd., completed the construction of the Cloudbreak open pit iron ore mine, and the first shipment of ore was delivered to China in May 2008. The construction of the company's Anderson Point shiploading facilities and 256-km of rail infrastructure was in progress and was scheduled to be completed in 2009. The port and railway system was designed to handle 55 Mt/yr of ore. The Christmas Creek open pit iron ore mine was under construction and was expected to be completed in early 2009. The Christmas Creek and the Cloudbreak Mines are located 50 km apart in the Chichester Ranges in the Pilbara region. The two mines had a total ore reserve of 1.5 billion metric tons (Gt) at average grades of 58.8% iron, 4.18% silica, 2.36% alumina, and 0.056% phosphorus. The total iron ore resources under the Fortescue's tenement holdings could reach 4.1 Gt. Baosteel and Fortescue signed an exploration agreement on the prospective magnetite deposits in Glacier Valley. Baosteel agreed to pay for all exploration expenses and could earn up to 50% interest if the identified iron ore resources were more than 1 Gt. Fortsecue was seeking investors from a company in China and other international companies to provide funding for its $3 billion expansion plan to increase iron ore production capacity to 120 Mt/yr (Fortescue Metals Group Ltd., 2008, p. 12; 2009, p. 10).

Atlas Iron Ltd. had property that covered an area of more than 15,000 km^2 in the northeast Pilbara region. In 2007, the company completed a feasibility study of the Pardoo direct-shipping ore body, which is located 75 km from Port Hedland. Construction at the Pardoo Mine began in October 2008, and ore was transported to Port Hedland within 4 weeks. Atlas and Fortescue signed an infrastructure agreement to use Fortescue's shiploading facilities on a fee-for-service basis. The Pardoo deposit had ore resources of 28.1 Mt at a grade of 56.1% iron. The mine was designed to produce 1 Mt/yr during its first 12 months of operation, and the company planned to expand the output capacity to 3 Mt/yr by 2010. Atlas also planned to develop the Abydos, the Mount Webber, and the Wodgina deposits in the tenement holding area. The company planned to commence the construction of the Wodgina Mine in early 2010 to increase the company's iron ore production capacity to 6 Mt/yr. The Wodgina deposit, which is located 100 km south of Port Hedland immediately adjacent to the existing Wodgina tantalum mine, had resources of 42.1 Mt at a grade of 56.3%

iron. The Abydos deposit is located 100 km south-southeast of Port Hedland and had identified iron ore resources of 22.3 Mt at a grade of 57.1% iron. Atlas planned to construct a mine on the Abydos deposit to produce 3 Mt/yr of direct-shipping ore in 2011. The Mount Webber deposit is located 75 km southeast of the Wodgina deposit, which had identified iron ore resources of 32.6 Mt at a grade of 57.3% iron. A prefeasibility study of the Mount Webber development was underway. Atlas foresaw that development of the Mount Webber deposit would achieve the company's target to produce 12 Mt/yr of iron ore by 2012 (Atlas Iron Ltd., 2009, p. 6-17).

Australia's pig iron was produced from the Hismelt pig iron plant and two integrated plants—Blue Scope Steel Ltd.'s Port Kembla plant and OneSteel Ltd.'s Whyalla plant. Owing to weak demand for iron and steel products, Rio Tinto decided to shut down its Hismelt plant operation in December 2008 and planned to restart the plant in April 2010. Ferrowest Ltd.'s Yalgoo iron project had a 500,000-t/yr ironmaking plant that could produce 96% direct-reduced iron. The plant would be equipped with Midrex's ITmk3® technology, and iron ore would be supplied from Ferrowest's Yogi magnetite deposit near Yalgoo, Western Australia. An engineering study was completed in 2008 and the plant was expected to be operating at full capacity in 2011 (Ferrowest Ltd., 2009; Rio Tinto plc, 2009b, p. 2).

Lead, Silver, and Zinc.—Australia's lead, silver, and zinc mines were predominantly based on ore bodies with zinc as the major component and lead and silver as byproducts. An exception was BHP Billiton's Cannington underground mine in the State of Queensland where lead and silver were major components and zinc was a minor component. In 2008, Australian zinc mine production was higher than in 2007. The increased zinc production came from such existing mines as Cannington and Century in Queensland, the reopened Hellyer Mine in the State of Tasmania, and the Jaguar Mine in the State of Western Australia. In 2008, Australia exported 222,000 t of lead concentrates. The Republic of Korea was the leading destination for Australian lead concentrate exports and accounted for 28% of the total followed by China, 27%; Japan, 20%; and Belgium, 10%; the remaining went to other countries in the world. Australia also exported 218,000 t of refined lead, for which the Republic of Korea was also the leading destination followed by Hong Kong, Malaysia, Thailand, and India. In 2008, Australia exported 996,000 t of zinc concentrates mainly to such East Asian countries as China, Japan, and the Republic of Korea. Zinc metal exports increased by about 3% to 415,000 t and went to such destinations as, in descending order of volume exported, Taiwan, Hong Kong, Malaysia, Saudi Arabia, and Indonesia (Australian Bureau of Agricultural and Resource Economics, 2009d, p. 290, 342).

The discussion between CBH Resources Ltd. and Perilya Ltd. on merging their Broken Hill operations failed to proceed despite projected cost savings estimated to be up to $200 million. CBH Resources placed its Endeavor operation on care-and-maintenance status in the second half of 2008. In response to the collapse in metal prices and the global financial crisis, Perilya turned to China's Shenzhen Zhongjin Lingnan Nonfemet Co. Ltd. for financial support in 2008. Zhongjin Lingnan agreed to inject A$45,464,560 in cash to secure a 50.1% interest in Perilya, and shareholders were expected to approve the transaction in early 2009. Zhongjin Lingnan's interest in Perilya was expected to increase to 52% at yearend 2009. In 2008, Perilya decided to resize the Broken Hill operation to focus on sustaining long-term production. Ore production at the Broken Hill Southern operation decreased to about 0.95 Mt from about 1.6 Mt and production at other mining locations was halted. The new operation plan was based on the resequencing of mining areas and focused on production cost control rather than on a short-term high-grade approach. As a result, the production cost was reduced to $0.59 per pound of payable zinc from $1.01 per pound before the resize. The Southern operation had ore resources of 10.0 Mt at average grades of 6.1% zinc, 4.5% lead, and 46.7 g/t silver. The Broken Hill operation had ore resources of 19.3 Mt at average grades of 9.4% zinc, 7.3% lead, and 90.8 g/t silver (Perilya Ltd., 2009, p. 18).

Oxiana Ltd., which operated the Golden Grove and the Prominent Hill Mines, and Zinifex Ltd., which operated the Century, the Dugald River, and the Rosebery mines, merged to form OZ Minerals Ltd. in 2008. As a result of decreasing metal prices and high operation costs, OZ Minerals faced financial issues soon after it was formed mainly because of the construction of the Prominent Hill operation. OZ Minerals discussed investment issues with Minmetals (Creamer Media (Pty) Ltd., 2009b).

Xstrata completed the construction of its McArthur River open pit mine, which is located 60 km southwest of the township of Borroloola, Northern Territory, in 2008. The underground operation, which had commenced in 1995, was being converted to an open pit operation. The government of the Northern Territory had approved the development of the open pit operation in 2006. In 2007, Xstrata decided to increase the McArthur River concentrator throughput capacity to 2.5 Mt/yr from 1.8 Mt/yr. The mine had an ore resource of 43 Mt at grades of 10.2% zinc, 4.4% lead, and 45 g/t silver (McArthur River Mining Pty Ltd., 2009).

Molybdenum and Tungsten.—No molybdenum production was recorded in Australia in 2008. Queensland Ores Ltd. reported that the company was processing the first ton of molybdenum concentrates at its Wolfram Camp molybdenum-tungsten project, which is located 90 km west of Cairns in Queensland, in June 2008. The Wolfram Camp, which was discovered in 1894, has been previously mined for bismuth, molybdenite, wolframite, and mixed concentrates. Since 2004, Queensland Ores has explored the central portion of the prospective near-surface mineralization. The mine contained 598,200 t of measured resources at average grades of 0.42% tungsten trioxide, 0.17% molybdenum sulfide, and 0.03% bismuth. The processing plant was designed to process 150,000 t/yr of ore and to produce tungsten concentrates containing 65% tungsten oxide, molybdenum concentrates containing 50% molybdenum, and bismuthinite concentrate assaying 40.4% bismuth. The company, however, suspended the operation in November 2008 because of mining and metallurgical issues involving the performance of the processing plant and the production of the concentrates. The company had difficulties delivering the targeted grade material to the processing plant, and the treatment plant had technical problems recovering an acceptable quality of concentrates from the ore feed. Queensland Ores had difficulties securing appropriate funding to continue operations at the Wolfram Camp project and the falling price of molybdenum in late 2008 compounded these issues. The company looked for investors to take over the project (Geoscience Australia, 2009, p. 51).

Moly Mines Ltd.'s subsidiary Moly Metals Australia Pty Ltd. contracted SRK Consulting (Australasia) Pty Ltd. to perform a technical study on the Spinifex Ridge molybdenum mine, which is located 50 km northeast of Marble Bar in the Pilbara region of the State of Western Australia, in 2008. The Spinifex Ridge had measured and indicated mineral reserves of 652 Mt at average grades of 0.05% molybdenum, 0.08% copper, and 1.3 g/t silver. Initially, in 2007, Moly Metals planned to develop and operate a 20-Mt/yr open pit mining operation and processing plant. Owing to a decline in molybdenum prices in late 2008, the company decided to change the ore throughput rate to 10 Mt/yr and to increase it to 20 Mt/yr in the seventh year, if warranted. The mineral resource at the Spinifex Ridge deposit was expected to support a mining operation for a period of 20 years. The company obtained approval by way of a Land Access Deed with representatives of the Njamal People of the east Pilbara; it obtained the environmental impact assessment and other pursuant permits to Mining Act WA 1978 and other statutes from Western Australia. The construction of the mine would begin in 2010 and the production of copper and molybdenum concentrates was scheduled to begin during the second half 2011 (Moly Mines Ltd., 2009, p. 6).

Australia also produced tungsten ore from the Kara Mine in Tasmania and the Wolfram Camp project. The scheelite concentrates from Kara contained an average of 55.7% tungsten trioxide. A trial shipment of 5.5 t of wolframite concentrate from the Wolfram Camp was exported.

Tantalum and Lithium.—Western Australia had two tantalum producers: Haddington Resources Ltd. and Talison Minerals Pty Ltd. Haddington reassessed the feasibility of the Bald Hill Mine and the Bald Hill extended area and decided that the mineralization would be uneconomical given the current market for tantalum. The Bald Hill Mine had remained on care-and-maintenance status since 2005 and Haddington sold the Bald Hill tenements, equipment, and plant in 2008 (Haddington Resources Ltd., 2009, p. 11).

In August 2007, Talison Minerals Pty Ltd. acquired the Greenbushes and the Wodgina Mines in Western Australia from Sons of Gwalia Ltd. The Wodgina's processing plant had a design capacity of 3.2 Mt/yr and produced tantalum concentrates at a grade of between 8% and 10% tantalum oxide. The concentrates were shipped to the Greenbushes operation for secondary processing, and about 550 t/yr of tantalum oxide was produced. The output of the Wodgina Mine accounted for about 30% of the world's tantalum. Tantalum was used primarily in the aerospace, electronics, medical, and nuclear power industries. Owing to a collapse in global demand and falling metal prices, Talison suspended its Wodgina tantalum operation in December 2008. Lower priced tantalum from central Africa, particularly from the Democratic Republic of the Congo [Congo (Kinshasa)], supplied a significant amount of tantalum to the world market. Reopening of the Wodgina tantalum mine would depend on market conditions. The Greenbushes tantalum underground operation remained on care-and-maintenance status in 2008. The company continued producing spodumene concentrate at Greenbushes, which contained a 35.5-Mt resource at an average grade of 3.31% lithium oxide. Talison planned to increase the ore throughput capacity to 600,000 metric tons per day to produce about 260,000 t/yr of lithium concentrates in 2009 (Talison Minerals Pty Ltd., 2008).

Industrial Minerals

Cement.—Australia has three major integrated cement companies (Adelaide Brighton Cement Pty Ltd., Blue Circle Southern Cement Ltd., and Cement Australia Pty Ltd.) and a number of small independent companies. The three major cement companies accounted for all integrated production of clinker and cement in Australia. Domestic clinker capacity was about 8 Mt/yr and cement capacity was about 9 Mt/yr. During the past several years, the three integrated cement producers produced about 8.5 Mt/yr for the domestic market. Small independent producers used imported clinker from Asian countries to produce cement and accounted for about 15% of the domestic supply of cement. Owing to environmental concerns and price competition from Asian cement producers, Australian cement producers were reluctant to expand their output capacity. Domestic analysts estimated that cement demand in Australia was expected to increase by 1.25% per year. The cement industry aimed to enhance the long-term sustainability of the industry and was focusing on such issues as energy efficiency, greenhouse emissions, regulatory reform, and transportation costs (Department of Resources, Energy, and Tourism, 2009, p. 21-26).

Diamond.—Australia was one of the leading diamond producing countries in the world. Diamond production was mainly from the Argyle and the Ellendale Mines in Western Australia. Argyle production was mostly industrial and lower quality gem diamond with an average price of less than $20 per carat. Rio Tinto and Wal-Mart Store Inc. jointly produced jewelry using diamond, gold, and silver from Rio Tinto mines. In 2005, Rio Tinto had invested $760 million to develop an underground block-caving operation; bringing the underground mine into full operation was expected to take 3 years. The capital cost was revised to $1.5 billion. The construction of major underground infrastructure was scheduled to begin in 2008, and full operation was expected to begin in 2010. In response to weak demand and prices, Rio Tinto decided to delay some critical development activities by reducing the workforce at the project. Full operation of the underground block cave would not take place until 2013. Output from the underground operation would account for 60% of Argyle's total output. The open pit operation was scheduled to be shut down in 2008; however, it was likely to be extended to 2011. The diamond output from the Argyle Mine was decreased because the AK1 pit experienced a wall failure at the end 2007. As a result, ore volume from the mine to the processing plant was decreased and lower grade stockpile ore was processed at the recovery plant. Mining would continue in the southern end of the pit to extract the remaining economic ore until 2009; mining would also be done at the northern bowl (Rio Tinto plc, 2009a, p. 53).

Phosphate Rock.—Australian phosphate rock production was mainly from the Phosphate Hill-Duchess Mine in Queensland, the phosphate mine on Christmas Island, and several small operations near Bendleby in South Australia. Legend International Holdings, Inc. planned to develop its Paradise South (formerly known as Lady Annie) and Paradise North (formerly known as Lady Jane) deposits in the Georgina Basin, Queensland. The deposits were discovered by BH South Ltd. in 1967 and had 486 Mt of resources at a grade of 17% phosphorus pentoxide. Legend decided to construct a 10-Mt/yr phosphate rock mine and a 5-Mt/yr beneficiation plant. The company planned to transport 5 Mt of phosphate rock slurry by a 300-km pipeline to a port facility in the Gulf of Carpentaria and to export it to the Indian Farmers Fertilizer Cooperative Ltd. under an offtake agreement for the purchase of up to 5 Mt/yr. The mining was scheduled to commence in 2009 and exports were planned to be between about 0.5 and 1 Mt of direct-shipping ore at grades of between 30% and 34% phosphate in 2010. Legend and China's Wengfu Group Co. Ltd. signed a strategic alliance agreement. Wengfu would provide assistance, such as mining and beneficiation of phosphate rock, at Legend's Georgina Basin phosphate project (Legend International Holdings, Inc., 2009).

Rare Earths.—Globally, the production and resources of rare earths was dominated by China. In 2008, there was no recorded production of rare earths in Australia. However, Lynas Corp. Ltd. completed a feasibility study and received Government approval to develop the Mount Weld rare-earth project. The feasibility study indicated that the Mount Weld deposit contained 12.24 Mt of resources (measured, indicated, and inferred) at an average grade of 9.7% rare-earth oxide (REO) at a cutoff of 2.5% REO. Lynas started the construction of the open pit mine and a concentration plant at the Mount Weld deposit in 2007; the deposit was located 35 km south of Laverton, Western Australia. Owing to the global financial crisis, Lynas had difficulty securing funding to continue in 2008 and the project was suspended. Lynas was looking for investors to participate in the development of the Mount Weld project. China Nonferrous Metal Mining (Group) Co. Ltd. was willing to arrange funding to support the Mount Weld project and to become a major shareholder in Lynas. The proposal investment was subject to regulatory and shareholder approval (Lynas Corp. Ltd., 2009, p. 3).

Alkane Resources Ltd.'s Dubbo Zirconia project, which is located 20 km south of Dubbo in New South Wales, had built a pilot plant to recover hafnium, niobium, rare-earth elements, tantalum, and zirconium. The company reported total (measured and inferred) resources of 73.20 Mt grading 1.96% zirconium oxide, 0.75% REO, 0.46% niobium oxide, 0.14% yttrium oxide, 0.04% hafnium oxide, and 0.014% uranium oxide. The process optimization and development work was conducted at the Australian Nuclear Science and Technology Organization at Lucas Heights (south of Sydney), and the pilot plant was designed to test the flowsheet and provide process and engineering data in 2008. Experimental results demonstrated that yttrium and rare-earth elements could be recovered from the niobium product participates. The company expected that the results from the pilot plant operations could lead to the development of a 200,000-t/yr ore processing plant to produce intermediate zirconium chemicals, niobium-tantalum concentrates, light rare-earth and yttrium-rare-earth concentrates. The definitive feasibility study would be carried out in 2009, and a final project development decision would be made in 2010 (Alkane Resources Ltd., 2009, p. 9-10).

Mineral Fuels and Related Materials

Coal.—Australia ranked behind China and India in the Asia and the Pacific region in coal output; the country, however, was the world's leading exporter of coal. Queensland and New South Wales were Australia's leading coal producing States and accounted for more than 95% of the country's total output. In 2008, Australia mined out 431 Mt of raw coal, of which 332 Mt of salable coal was black (bituminous and anthracite) coal. Queensland's coal output accounted for 54.8% of the country's total output and was mainly from the Bowen Basin, which extends south from Collinsville to Blackwater and Moura, and from mines at Blair Athol, Newlands, and near Brisbane. New South Wales's coal output accounted for 42.6% of the country's total output and was mined near the eastern and western edges of the large Sydney Gunnedah Basin. In 2008, Australia exported more than 261.2 Mt of coal (metallurgical coal, 134.8 Mt, and thermal coal, 126.4 Mt) compared with 250 Mt in 2007. Japan was the leading destination for Australian metallurgical coal, 37.7%; followed by India, 18.4%; the European Union, 16.3%; the Republic of Korea, 4.8%; and others 22.8%. Japan also was the leading destination for Australian thermal coal, 53.8%; followed by the Republic of Korea, 19.4%; Taiwan, 15.7%; and others, 11.1%. Domestic coal consumption was less than 70 Mt, of which the power sector accounted for about 85%; followed by steel, 6.7%; cement, 1.3%; and other, 7%. The Australian Government projected that Australian production of salable coal would increase to 404 Mt and exports would increase to 325 Mt in 2014 (Australian Bureau of Agricultural and Resource Economics, 2009d, p. 17).

The infrastructure bottlenecks held back Australia's mineral exports, especially coal. The government of Queensland committed $5 billion to expand coal transport infrastructure, including state-owned railways and ports and privately owned coal terminals. The total export capacity of rail and port systems would enable coal exports of more than 210 Mt/yr in 2010. The coal handling capacity of the Abbot Point, Brisbane, Gladstone, and Hay Point coal export terminals would be increased to 230 Mt in 2009 and then to 340 Mt if the State government of Queensland deemed it necessary. The government of Queensland also planned to list its coal and rail freight network for sale, and the State would keep between 25% and 40% of the business. The State government of New South Wales decided to increase the coal royalty tax rate by 1.5% to cover infrastructure development funding (Williams, 2008; Department of Primary Industries of New South Wales, 2009, p. 29).

Waratah Coal Pty Ltd. announced that the company had discovered coal resources of 4.4 Gt at the Galilee Basin in Queensland. Waratah Coal proposed to construct a 40-Mt/yr coal mine near Alpha (west of Emerald) and named it the "China First project." The China First project would use a right to mine 1.4 Gt of coal from tenements EPC 1040 and

EPC 1079 for 25 years. The development cost was estimated to be $6.75 billion (A$7.5 billion), which included the construction of a mine, processing plants, a 450-megawatt powerplant, and a 490-km railway line linking the mine site to the export coal terminal at Abbot Point. Waratah Coal signed a memorandum of understanding with China's state-owned China Metallurgical Group Corp. (MCC), for which MCC would provide the engineering and construction support for the China First project and would provide or arrange for 10% of the capital funding needed for the project. Under the terms of arrangement, MCC would have the right to purchase 30 Mt/yr of coal (Waratah Coal Pty Ltd., 2008, 2009).

Natural Gas and Petroleum.—The States of Western Australia and Victoria accounted for most of Australia's oil and condensate and liquefied natural gas (LNG) production. The Carnarvon Basin, which is located off the coast of Western Australia, accounted for 63% of the country's total production. Production from the Carnarvon Basin was mostly exported, and production from the Gippsland Basin, which is located off the coast of Victoria in southeastern Australia, was used mainly to feed local refineries. In 2008, Australia's oil production decreased slightly from that of 2007. The Angel condensate and gas project, which was located 115 km offshore Western Australia and the Vincent oil project, which was located off the shore of North West Cape, Western Australia, started production in 2008. Australian oil production was expected to increase by about 2% during the next several years. The increase would come from the Crux and the Skua/Swift oilfields in the Bonaparte Basin; the Basker/Manter, the Kipper, and the Turrum oilfields in the Gippsland Basin; and the Pyrenees and the Van Gogh/Coniston oilfields in the Carnarvon Basin. Australia was a net importer of oil and refinery products. In 2008, the country's net imports of crude oil and condensate totaled 64.46 million barrels (Mbbl) (10,248 million liters), and imported petroleum products totaled 101.74 Mbbl (16,175 million liters) (Australian Bureau of Agricultural and Resource Economics, 2009b, p. 141).

Uranium.—Australia was the second ranked uranium producer in the world after Canada. Australia's uranium production was mainly from three mines—the Beverley, the Olympic Dam, and the Ranger. A number of undeveloped deposits in the Northern Territory, Queensland, South Australia, and Western Australia also exist. The Australian Government permits uranium mining, provided that all the relevant environmental safeguards and health requirements are met. Regulation of Australia's uranium mines is mainly a State and Territorial government responsibility. Among the States and Territories, only the governments of the Northern Territory and South Australia permitted uranium mining before 2008. Western Australia lifted the ban on uranium mining in the State in 2008. BHP Billiton planned to reactivate its Yeelirrie uranium project in Western Australia. Owing to financial problems, Uranium One Inc. suspended the construction of the Honeymoon project in South Australia, but restarted construction after Japan's Alliance Resources Ltd. and Mitsui & Co. Ltd. purchased a 49% equity share in the project (Geoscience Australia, 2009, p. 81).

Outlook

Australia is a natural resource-rich country with significant resources of metallic, nonmetallic, and fuel minerals. Mineral and energy commodity exports are an important part of the country's economy. Reflecting strong world demand for mineral resources, especially in the Asia and the Pacific region, the Australian economy is expected to continue to benefit from higher commodity export earnings. Expenditures on mineral and energy exploration in Australia are expected to increase owing to higher costs of labor and equipment and global demand for natural resources in the future. Owing to global financial problems, the production of such commodities as bauxite, copper, iron ore, natural gas, nickel, and zinc is expected to slow down during the next several years. Major projects, such as the Yarwun alumina refinery project; BHP Billiton's RGP for iron ore; Hamersley Iron's Yandicoogina iron ore expansion; Fortescue Metals' iron ore project; Rio Tinto's Brockman 4, Hope Downs, and Mesa A iron ore projects and Clermont and Kestrel coal projects; and Xstrata's Mangoola coal project are expected to come onstream within this decade. Western Australia is Australia's leading State for metallic mineral exports and New South Wales and Queensland are major coal exporting States; however, to sustain export growth, the country's infrastructure requires significant expansion and upgrading so that minerals for export can be transported from inland to port terminals. Australia is expected to remain a major mineral and fuel exporting country.

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TABLE 1
AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless othewise specified)

Commodity		2004	2005	2006	2007	2008
METALS						
Aluminum:						
Bauxite, gross weight	thousand metric tons	43,993	59,959	61,780	62,398	64,038
Alumina	do.	16,525	17,704	18,312	18,844	19,446
Metal, refined:						
Primary	do.	1,894	1,903	1,932	1,957	1,974
Secondary[e]		127,000	127,000	130,000	130,000	130,000
Antimony, Sb content of ores and concentrates[e]		120	120	1,600	1,010	1,500
Cadmium:[e]						
Mine output, Cd content		700	700	700	700	700
Metal, smelter, refined		350	360	330	350	330
Chromium, chromite, gross weight		265,937 [r]	241,865 [r]	258,087 [r]	253,400 [r]	224,809
Chromite content[e]		105,000 [r]	97,000 [r]	103,000 [r]	103,000 [r]	90,000
Cobalt:						
Co content in laterite ore, Ni concentrate, and Zn concentrate[e]		5,600	5,600	6,000	5,900	5,500
Metal, refined		3,880	3,150	3,700	3,680	3,500 [e]
Copper:						
Mine output, Cu content	thousand metric tons	875	930	879	870 [r]	885
Metal:						
Smelter, primary and secondary	do.	440	412	377	399	447
Refined, primary	do.	498	461	429	442	503
Gold:						
Mine output, Au content		258	263	246	247 [r]	215
Metal, refined:						
Primary		313	291	266	259	244
Secondary		58	50	112	116	117
Iron and steel:						
Iron ore:[e]						
Gross weight	thousand metric tons	234,000 [r]	262,000 [r]	275,000 [r]	299,000 [r]	342,000
Fe content	do.	144,000 [r]	163,000 [r]	171,000 [r]	186,000 [r]	208,000
Metal:						
Pig iron	do.	5,735	6,203	6,433	6,351	6,409
Ferroalloys:[e]						
Ferromanganese		115,000	120,000	125,000	125,000	125,000
Silicomanganese		135,000	135,000	140,000	140,000	140,000
Total		250,000	255,000	265,000	265,000	265,000
Steel, crude	thousand metric tons	8,353	7,788	7,937	8,047	7,724
Semimanufactured products		6,671	6,920	7,000	7,200 [e]	7,000 [e]
Lead:						
Mine output, Pb content	thousand metric tons	674	767	686	641	645
Metal:						
Bullion	do.	140	159	118	125	167
Refined:						
Primary	do.	232	230	233	202	220
Secondary, excluding remelt	do.	36	33	27	27	24
Manganese ore, metallurgical:						
Gross weight	do.	3,431	3,830	4,549 [r]	5,265 [r]	4,812
Mn content	do.	1,570	1,908	2,190 [r]	2,540 [r]	2,310
Nickel:						
Mine output, Ni content	do.	175 [r]	192 [r]	175 [r]	160 [r]	188
Matte	do.	32 [r]	44 [r]	39 [r]	42 [r]	31
Metal, smelter, refined Ni and Ni content of oxide	do.	122	126	119	114	103
Platinum-group metals:[e]						
Palladium, Pd content	kilograms	800	550	750	600	700
Platinum, Pt content	do.	200	111	209	142	200
Total	do.	1,000	661	959	742	900
Silver:						
Mine output, Ag content		2,224	2,417	1,727	1,879	1,926
Metal, refined		650	727	634	625	644

See footnotes at end of table.

TABLE 1—Continued
AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
METALS—Continued						
Tantalum, tantalite, Ta_2O_5 equivalent		985	1,043	584	538[r]	680
Tin:						
Mine output, Sn content		1,196	2,819	1,478	2,071	1,783
Metal, refined:						
Primary		467	594	572	118	--
Secondary[e]		400	400	400	400	400
Titanium concentrates, gross weight:						
Ilmenite	thousand metric tons	1,921	2,030	2,377	2,340[r]	2,082
Leucoxene[e]		44,000	46,000	131,000	163,000[r]	148,000
Rutile		163,000	177,000	232,000	312,000[r]	325,000
Zinc:						
Mine output, Zn content	thousand metric tons	1,334	1,367	1,362	1,514	1,519
Metal, smelter:						
Primary	do.	470	457	463	502	499
Secondary[e]		6,000[r]	6,000[r]	6,000[r]	6,000[r]	6,000
Zirconium concentrates, gross weight	thousand metric tons	441	427	491	601[r]	550
INDUSTRIAL MINERALS						
Abrasives, natural:						
Beach pebble[e]		2,000	2,000	2,000	2,000	2,000
Garnet		125,404	246,128	278,233	294,007	294,007
Barite[e]		20,000	20,000	21,000	21,000	21,000
Cement, hydraulic[e]	thousand metric tons	8,000	8,475[2]	9,000	9,500	9,400
Clays:[e]						
Bentonite and bentonitic clay		265,000	223,000	220,000	220,000	220,000
Brick clay and shale	thousand metric tons	8,000	8,000	8,000	8,000	8,000
Cement clay and shale	do.	500	500	500	500	500
Damourite clay		100	100	100	100	100
Fire clay		25,000	25,000	25,000	22,000	22,000
Fuller's earth, attapulgite		10,000	9,800	10,000	10,000	10,000
Kaolin and ball clay		285,000	230,000	250,000	230,000	230,000
Other	thousand metric tons	2,000	2,000	2,000	2,000	2,000
Diamond:						
Gem	thousand carats	6,008	8,577	7,305	231	273
Industrial	do.	18,172	25,730	21,915	18,960	15,397
Total	do.	24,180	34,307	29,220	19,191	15,670
Diatomite[e]		20,000	20,000	20,000	20,000	20,000
Feldspar, including nepheline syenite[e]		50,000	50,000	50,000	50,000	50,000
Gemstones, opal	value, $million	36	40	50	40	41
Gypsum	thousand metric tons	4,325	3,857	4,265	3,896	3,500[e]
Kyanite[e]		1,000	1,000	1,000	1,000	1,000
Lime[e]		1,500,000	1,500,000	1,600,000[r]	1,600,000[r]	1,600,000
Lithium, spodumene		118,451	173,635	222,101	192,277	239,528
Magnesite		473,983	474,000	446,000	447,000	126,000
Nitrogen, N content of ammonia		790,000	790,000	1,200,000	1,200,000	1,200,000
Perlite, crude[e]		5,000	6,000	6,500	6,500	6,500
Phosphate rock:[e]						
Gross weight		2,200,000	2,080,000	2,140,000[r]	2,850,000	2,950,000
P_2O_5 content		506,000	478,000	493,000	655,000	678,000
Salt[3]	thousand metric tons	11,088	12,444	11,424	10,855	11,160
Soda ash[e]	do.	300	300	310	310	310
Stone and sand and gravel:						
Construction sand	thousand metric tons	27,995	30,438	30,540[r]	35,530[r]	34,000[e]
Crushed and broken stone[e]	do.	76,000[r]	75,000[r]	81,000[r]	95,000[r]	80,000[e]
Dimension stone	do.	266	237	200	190[r]	230[e]
Gravel[e]	do.	13,000[r]	14,000[r]	13,500[r]	13,600[r]	12,000
Dolomite[e]	do.	10,000	10,000	10,000	10,000	10,000
Limestone[e]	do.	17,100[r]	18,400[r]	18,300[r]	19,100[r]	19,000
Silica in the form of quartz, quartzite, glass sand	do.	4,142	5,169	5,200[e]	5,200[e]	5,200[e]

See footnotes at end of table.

TABLE 1—Continued
AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
INDUSTRIAL MINERALS—Continued						
Sulfur, byproduct:[e]						
Metallurgy	thousand metric tons	870	880	880	880	880
Petroleum	do.	60	60	58	58	60
Total	do.	930	940	938	938	940
Talc, chlorite, pyrophyllite, steatite[e]		150,923 [2]	155,000	130,000	125,000	120,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, salable:						
Bituminous and subbituminous	thousand metric tons	298,000	303,000	309,000	320,000	332,000
Lignite[e]	do.	67,000	67,000	71,000	71,000	71,000
Total[e]	do.	365,000	370,000	380,000	391,000	403,000
Gas, natural, marketed	million cubic meters	41,680	42,630	44,100	39,960	38,256
Petroleum:						
Crude	thousand 42-gallon barrels	171,781	155,320	163,900	170,470 [r]	168,123
Refinery products	do.	280,242	255,863	229,748	252,443	246,717
Uranium, mine output, U_3O_8 content		10,600	11,218	8,970	10,145	9,989

[e] Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r] Revised. do. Ditto. -- Zero.

[1] Table includes data available through November 20, 2009.

[2] Reported figure.

[3] Does not include production from the Northern Territory and the State of Victoria.

TABLE 2
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Facilities, major operating companies, and major equity owners	Location of main facilities[1, 2]	Annual capacity[e]
Aluminum:			
Bauxite	Gove open pit bauxite mine (Rio Tinto Alcan, 100%)	15 km southeast of Nhulunbuy, NT	8,000
Do.	Huntly open pit bauxite mine (Alcoa World Alumina Australia, 100%)	80 km south of Perth, WA	20,000
Do.	Weipa-Andoom open pit bauxite mine [Comalco Ltd., operator (Rio Tinto Alcan, 100%)]	Weipa, QLD	21,000
Do.	Willowdale open pit bauxite mine (Alcoa World Alumina Australia, 100%)	130 km south of Perth, WA	8,600
Do.	Boddington-Worsley open pit bauxite mine {Worsley Alumina Pty. Ltd., manager [BHP Billiton Ltd., 86%; Japan Alumina Associates (Australia) Pty. Ltd., 10%; Sojitz Alumina Pty. Ltd., 4%]}	14 km south of Boddington, WA	13,200
Alumina refinery	Gladstone alumina refinery [Queensland Alumina Ltd., operator (Rio Tinto Alcan, 80%, and United Company RUSAL 20%)]	Gladstone, QLD	3,850
Do.	Gove alumina refinery [Alcan Gove Pty Ltd. (Rio Tinto Alcan, 100%)]	Nhulunbuy, Gove, NT	3,800
Do.	Kwinana alumina refinery (Alcoa World Alumina Australia, 100%)	Kwinana, WA	2,100
Do.	Pinjarra alumina refinery (Alcoa World Alumina Australia, 100%)	Pinjarra, WA	4,200
Do.	Wagerup alumina refinery (Alcoa World Alumina Australia, 60%, and Western Mining Corp., 40%)	Waroona, WA	2,600
Do.	Worsley alumina refinery [Worsley Alumina Pty. Ltd., manager (BHP Billiton Ltd., 86%, and Japan Alumina Associates (Australia) Pty Ltd., 10%)]	20 km northwest of Collie, WA	3,500
Do.	Yarwun alumina refinery (Rio Tinto Alcan, 100%)	Gladstone, QLD	1,400
Metal smelter	Bell Bay aluminum smelter (Rio Tinto Alcan, 100%)	Bell Bay, TAS	160
Do.	Kurri Kurri aluminum smelter (Hydro Aluminium Kurri Kurri Pty. Ltd., 100%)	Kurri Kurri, near Newcastle, NSW	165
Do.	Boyne Island aluminum smelter [Boyne Smelters Ltd., operator (Rio Tinto Alcan, 64%; Sumitomo Light Metal Industries Ltd., 17%; Ryowa Development Pty. Ltd., 12%; Kobe Steel Ltd., 5%; Sumitomo Chemical Co. Ltd., 2%)]	Boyne Island, QLD	550
Do.	Point Henry aluminum smelter (Alcoa of Australia, 100%)	Point Henry, VIC	185
Do.	Portland aluminum smelter [Alcoa of Australia, 55%, manager; China International Trust Investment Co. (China state-owned company), 22.5%; Marubeni Australia Pty. Ltd., 22.5%]	Portland, VIC	345
Do.	Tomago aluminum smelter [Tomago Aluminium Co. Pty. Ltd., operator (Gove Aluminium Finance Ltd., 36.05%; Rio Tinto Alcan, 51.55%; Hydro Aluminium, 12.40%)]	Tomago, NSW	525
Antimony	Augusta underground antimony-gold mine [AGD Mining operator (Cambrian Mining Plc, 100%)]	50 km east and southeast of Bendigo, VIC	5
Do.	Hillgrove Mine (Straits Resources Ltd., 100%)	25 km east of Armidale, NSW	10
Bentonite	Arumpo open pit bentonite mine (Arumpo Bentonite Pty. Ltd., 100%)	95 km northeast of Mildura, NSW	10
Do.	Cedars open pit bentonite mine (PCP Douglass Pty. Ltd., 100%)	10 km southwest of Yarraman, QLD	20
Do.	Cressfield open pit bentonite mine (Unimin Australia Ltd., 100%)	20 km north of Scone, NSW	12
Do.	Mantuan Downs (Pacific Enviromin Ltd., 100%)	West of Springsure, QLD	100
Do.	Miles open pit bentonite mine (Unimin Australia Ltd., 100%)	350 km west of Brisbane, QLD	100
Cement, plant	Adelaide Brighton Cement Pty Ltd., 100%	Angaston, SA	250
Do.	do.	Birkenhead, SA	1,200
Do.	do.	Geelong, VIC	800
Do.	do.	Munster, SA	590
Do.	Blue Circle Southern Cement Ltd., 100%	Berrima, NSW	1,200
Do.	do.	Maldon, NSW	700
Do.	do.	Waurn Ponds, VIC	250
Do.	Cement Australia Ltd., 100%	Brisbane, QLD	1,200
Do.	do.	Gladstone, QLD	1,600
Do.	do.	Kandos, NSW	450
Do.	do.	Railton, TAS	1,000
Do.	Cockburn Cement Ltd., 100%	Munster, 30 km south of Perth, WA	700
Chromite	Coobina open pit chromite mine (Palmary Enterprises Ltd., 100%)	80 km southeast of Newman, WA	250

See footnotes at end of table.

TABLE 2—Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Facilities, major operating companies, and major equity owners	Location of main facilities[1, 2]	Annual capacity[e]
Coal	Angus Place longwall coal mine (Centennial Coal Co. Ltd., 50%, and SK Corp., 50%)	16 km northwest of Lithgow, NSW	3,000
Do.	Appin longwall coal mine [Illawarra Coal Holdings Pty Ltd., operator (BHP Billiton Ltd., 100%)]	40 northwest of Wollongong, NSW	8,800
Do.	Ashton open pit/underground coal mine (Felix Resources Ltd., 60%; Chu Corp., 10%; private, 30%)	14 km northwest of Singleton, NSW	4,000
Do.	Awaba underground coal mine [Powercoal Pty. Ltd., operator (Centennial Coal Co. Ltd., 100%)]	30 km southwest of Newcastle, NSW	2,000
Do.	Baal Bone coal mine [Oakbridge Pty. Ltd., 74.1% (Xstrata plc, 100%); Sumitomo Corp., 5%; Toyota Tsusho Mining (Australia) Pty Ltd. 4.75%; private, 14.44%]	24 km northwest of Lithgow, NSW	2,500
Do.	Bengalla open pit coal mine [Coal and Allied Industries Ltd., 40%, manager; Wesfarmers Bengalla Ltd., 40%; MCDA Bengalla Investment Pty. Ltd., 10%; Taipower Bengalla Pty. Ltd., 10%]	5 km west of Muswellbrook, NSW	6,600
Do.	Blackwater open pit coal mine (includes South Blackwater) [BHP Billiton Mitsubishi Alliance, manager (BHP Billiton Ltd., 50%, and Mitsubishi Corp., 50%)]	195 km west of Rockhampton, QLD	14,000
Do.	Blair Athol open pit coal mine [Rio Tinto Ltd., 57.2%, manager; J-Power (Australia) Pty Ltd., 8%; private, 34.8%]	25 km northwest of Clermont, QLD	13,000
Do.	Broadmeadow open pit/underground coal mine [BHP Billiton Mitsubishi Alliance, manager (BHP Billiton Ltd., 50%, and Mitsubishi Corp., 50%)]	30 km north of Moranbah, QLD[3]	3,000
Do.	Bulga open pit coal mine [Oakbridge Pty Ltd., manager (Xstrata plc, 68.25%; Nippon Steel Australia Pty. Ltd., 12.5%; Toyota Tsusho Mining (Australia) Pty Ltd., 4.38%; private 13.3%)]	16 km southwest of Singleton, NSW	10,000
Do.	Burton open pit coal mine (Peabody Energy Corp., 95%, and Thiess Pty. Ltd., 5%)	150 km southwest of Mackay, QLD	5,800
Do.	Callide coal mine (Anglo Coal Pty Ltd., 100%)	120 km southwest of the Port of Gladstone, QLD	10,700
Do.	Camberwell open pit coal mine [Camberwell Coal Pty. Ltd., manager [Toyota Tsusho Mining (Australia) Pty. Ltd., 90%, and Dia Coal Mining (Australia) Pty Ltd., 10%]	10 km northwest of Singleton, NSW	4,000
Do.	Clarence underground coal mine (Centennial Coal Co. Ltd., 85%, manager; and SK Australia Pty. Ltd., 15%)	10 km east of Lithgow, NSW	2,500
Do.	Commodore open pit coal mine Roche Mining Pty. Ltd., operator [Intergen (Australia) Pty Ltd., 100%]	80 km southwest of Toowoomba, QLD	3,600
Do.	Coppabella open pit coal mine (Macarthur Coal Ltd., 73.3%, and others, 26.7%)	140 km southwest of Mackay, QLD	4,000
Do.	Cumnock No. 1 open pit coal mine (Cumnock Coal. Ltd., 100%)	28 km northwest of Singleton, NSW	3,000
Do.	Curragh open pit coal mine (Wesfarmers Ltd., 100%)	70 km east of Emerald, QLD	9,000
Do.	Dartbrook coal mine (Anglo Coal Holdings Australia Ltd., 77.3%)	70 km north of Singleton, NSW[3]	3,750
Do.	Dawson coal complex (includes Moura, Theodore, and Taroom) [Anglo American plc, 51%, and Mitsui & Co. (Australia) Ltd., 49%]	230 km west of Bundaberg, QLD	7,000
Do.	Dendrobium underground coal mine (BHP Billiton Ltd., 100%)	15 km southwest of Wollongong, NSW	5,200
Do.	Donaldson open pit coal mine (Donaldson Coal Pty Ltd., 100%)	5 km southeast of Maitland, NSW	2,500
Do.	Drayton open pit coal mine [Anglo Coal Holdings Australia Ltd., 88.2%, manager; Mitsui Coal Development Australia Pty. Ltd., 3.8%; Mitsui Mining (Australia) Pty. Ltd., 3%; others, 5%]	35 km northwest of Singleton, NSW	5,000
Do.	Duralie open pit coal mine (Gloucester Coal Ltd., 100%)	110 km of Newcastle, NSW	2,000
Do.	Elouera underground coal mine (Gujarat NRE Resources NL, 100%)	15 km southwest of Wollongong, NSW	2,000
Do.	Ensham-Yongala open pit coal mine [Idemitsu Kosan Co. Ltd., 85%; J-Power (Australia) Pty. Ltd., 10%; LG International (Australia) Pty Ltd., 5%]	40 km northeast of Emerald, QLD	9,000
Do.	Ewington II open pit coal mine (Griffin Coal Mining Co. Pty. Ltd., 100%)	8 km east of Collie, WA	1,000
Do.	Foxleigh open pit coal mine (Foxleigh Mining Pty Ltd., 100%)	Bowen Basin, QLD	3,600
Do.	German Creek and German Creek East open pit/underground coal mines [Anglo American plc, 70%, and Mitsui & Co. (Australia) Ltd., 30%]	275 km west-northwest of Rockhampton, QLD	6,000

See footnotes at end of table.

TABLE 2—Continued

AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Facilities, major operating companies, and major equity owners	Location of main facilities[1, 2]	Annual capacity[e]
Coal—Continued	Glennies Creek longwall coal mine (CVRD Inco Ltd., 85%; Nippon Steel Australia Pty Ltd., 5%; POSCO Australia Pty Ltd., 5%; private, 5%)	12 km north of Singleton, NSW	2,800
Do.	Goonyella-Riverside-Broadmeadow open pit coal mines (BHP Billiton Ltd., 50%, and Mitsubishi Corp., 50%)	140 km southwest of Mackay, QLD	16,000
Do.	Gregory Crinum open pit/underground coal mine [BHP Billiton Mitsubishi Alliance, manager (BHP Billiton Ltd., 50%, and Mitsubishi Corp., 50%)]	60 km north of Emerald, QLD	5,500
Do.	Hunter Valley Operations (includes Carrington Chestnut, Howick, Hunter Valley No. 1, Lemington, Riverview open pit coal mines) (Coal and Allied Industries Ltd., 100%)	10 km west and 25 km north of Singleton, NSW	15,000
Do.	Hail Creek open pit coal mine (Rio Tinto Ltd., 82%; Nippon Steel Australia Pty Ltd., 8%; Marubeni Coal Pty. Ltd., 6.66%)	100 km west of Mackay, QLD	8,000
Do.	Hazelwood open pit coal mine (International Power Hazelwood, 100%)	150 km southeast of Melbourne, VIC	20,000
Do.	Jellinbah East open pit coal mine (Queensland Coal Mine Management Pty. Ltd., 70%; Marubeni Coal Pty. Ltd., 15%; Sojitz Australia Ltd., 15%)	90 km east of Emerald, QLD	4,000
Do.	Kestrel underground coal mine [Rio Tinto Ltd., 80%, and Mitsui & Co. (Australia) Ltd., 20%]	40 km north-northeast of Emerald, QLD	5,500
Do.	Liddell open pit coal mine (Xstrata Coal Australia Pty. Ltd., 67.5%, and Mitsui Matushima Australia Pty. Ltd., 32.5%)	25 km northwest of Singleton, NSW	4,000
Do.	Loy Yang open pit coal mine (Loy Yang Power Ltd., 100%)	165 km east of Melbourne, VIC	30,000
Do.	Mondalong underground coal mine (Centennial Coal Co. Ltd., 100%)	35 km southwest of Newcastle, NSW	4,500
Do.	Moorvale open pit coal mine (Macarthur Coal Ltd., 73.3%; CITIC Resources Australia Pty Ltd., 7%; Sojtz Australia Ltd., 7%; Nippon Steel Australia Pty Ltd., 2%)	10 km south of Coppabella, QLD	3,400
Do.	Moranbah North longwall coal mine (Anglo American plc., 88%, and Nippon Steel Australia Pty. Ltd., 5%)	150 km southwest of Mackay, QLD	5,800
Do.	Mount Arthur open pit coal mine (BHP Billiton Ltd., 100%)	5 km southwest of Muswellbrook, NSW	15,000
Do.	Mount Owen open pit coal mine (Xstrata plc, 100%)	20 km northwest of Singleton, NSW	7,700
Do.	Mount Thorley open pit coal mine (Coal and Allied Industries Ltd., 80%, and POSCO Australia Pty. Ltd., 20%)	14 km southwest of Singleton, NSW	12,000
Do.	Muja open pit coal mine (The Griffin Coal Mining Co. Pty. Ltd., 100%)	18 km southeast of Collie, WA	2,000
Do.	Muswellbrook No. 2 open pit coal mine (Muswellbrook Coal Co., 100%)	4 km northeast of Muswellbrook, NSW	1,700
Do.	Myuna underground coal mine (Centennial Coal Co. Ltd., 100%)	35 km south of Newcastle, NSW	1,500
Do.	New Acland open pit coal mine (New Hope Corp. Ltd., 100%)	35 km northwest of Toowoomba, QLD	3,750
Do.	Newlands-Collinsville-Abbot Point open pit coal mine (Xstrata plc, 55%; Itochu Corp., 35%; Sumitomo Corp., 10%)	130 km west of Mackay, QLD	15,000
Do.	Newstan longwall coal mine (Centennial Coal Co. Ltd., 100%)	30 km southwest of Newcastle, NSW	4,000
Do.	North Goonyella underground coal mine (Peabody Energy Corp., 100%)	40 km north Moranbah, QLD	3,000
Do.	Norwich Park open pit coal mine (BHP Billiton Ltd., 50%, and Mitsubishi Corp., 50%)	85 km north-northeast of Emerald, QLD	5,000
Do.	Oaky Creek longwall and Alliance open pit coal mines (Xstrata plc, 55%; Sumitomo Coal Australia Pty. Ltd., 25%; Itocho Corp., 20%)	300 km west-northwest of Rockhampton, QLD	9,500
Do.	Peak Downs open pit coal mine (BHP Billiton Ltd., 50%, and Mitsubishi Development Pty. Ltd., 50%)	145 km north of Emerald, QLD	9,000
Do.	Premier open pit coal mine (Wesfarmers Premier Coal Ltd., 100%)	10 km southeast of Collie, WA	4,000
Do.	Ravensworth-Narama open pit coal mine (includes Ravensworth East) (Xstrata Coal Australia Pty. Ltd., 100% of Ravensworth and 50% of Narama; Iluka Resources Ltd., 50% of Narama)	20 km northwest of Singleton, NSW	3,500
Do.	Rixs Creek open pit coal mine (Bloomfield Colliers Pty. Ltd., 100%)	5 km northwest of Singleton, NSW	2,000
Do.	Rolleston open pit coal mine (Xstrata plc, 75%; Itochu Corp., 12.5%; Sumitomo Corp., 12.5%)	90 south-southeast of Emerald, QLD	8,000
Do.	Saraji open pit coal mine (BHP Billiton Ltd., 50%, and Mitsubishi Corp., 50%)	125 km north of Emerald, QLD	6,500
Do.	South Walker Creek open pit/underground coal mine (BHP Mitsui Coal Pty. Ltd., 100%)	90 km southwest of Mackay, QLD	4,300
Do.	Springvale underground coal mine (Centennial Coal Co. Ltd. 50%; SK Corp., 25%; Korea Resource Corp. Australia, 25%)	16 km northwest of Lithgow, NSW	3,000

See footnotes at end of table.

TABLE 2—Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Facilities, major operating companies, and major equity owners	Location of main facilities[1, 2]	Annual capacity[e]
Coal—Continued	Tahmoor longwall coal mine (includes Tahmoor North and Bargo) (Centennial Coal Co. Ltd., 85.79%, and private, 14.21%)	70 km southwest of Sydney, NSW	2,500
Do.	Tarong-Meandu open pit coal mine (Rio Tinto Ltd., 100%)	85 km north of Toowoomba, QLD	7,000
Do.	Ulan underground coal mine (Xstrata plc, 90%, and Mitsubishi Corp., 10%)	45 km northwest of Mudgee, NSW	5,000
Do.	United Collieries underground coal mine (Xstrata plc., 95%, and private, 5%)	15 km west of Singleton, NSW	3,000
Do.	Wambo open pit/underground coal mine (Peabody Energy Corp., 100%)	30 km from Singleton, NSW	6,000
Do.	West Cliff longwall coal mine (BHP Billiton Ltd., 100%)	43 km northwest of Wollongong, NSW	2,300
Do.	West Wallsend longwall coal mine (Xstrata plc, 70%; Marubeni Coal Pty Ltd., 17%; private 13%)	25 km southwest of Newcastle, NSW	2,500
Do.	Yallourn open pit lignite mine (CLP Power Asia Ltd., 100%)	140 km southeast of Melbourne, VIC	18,000
Cobalt:			
Mine	Cawse open pit nickel-cobalt mine (Norilsk Nickel Mining and Metallurgical Co., 100%)	50 km northwest of Kalgoorlie, WA	0.2
Do.	Murrin Murrin open pit nickel-cobalt mine (Minara Resources Ltd., 60%, and Glencore Australia Pty. Ltd., 40%)	60 km east of Leonora, WA	2.0
Do.	Radio Hill underground nickel-cobalt mine (Fox Resources Ltd., 100%)	35 km south of Karratha, WA	0.2
Do.	Ravensthorpe open pit mine (BHP Billiton Ltd., 100%)	155 km west of Esperance, WA	1.4
Refinery	Yabulu nickel-cobalt refinery (BHP Billiton Ltd., 100%)	Townsville, QLD	3
Copper:			
Mine, Cu content	Cadia Hill open pit gold-copper mine (Newcrest Mining Ltd., 100%)	21 km south-southwest of Orange, NSW	25
Do.	Cobar underground copper mine (Glencore International AG, 100%)	12 km northwest of Cobar, NSW	30
Do.	Eloise underground copper mine (FMR Investement Pty Ltd., 100%)	60 km southeast of Cloncurry, QLD	70
Do.	Ernest Henry open pit/underground copper-gold mine (Xstrata plc, 100%)	35 km northeast of Cloncurry, QLD	115
Do.	Golden Grove underground zinc-copper mine (Oxiana Ltd., 100%)	225 km east of Geraldton, WA	20
Do.	Hellyer underground zinc-lead-copper-silver mine (Bass Metals Ltd., 100%)	80 km south-southwest of Burnie, TAS	1
Do.	Lady Annie copper (SW-EX) mine (Cape Lambert Iron Ore Ltd., 100%)	100 km north-northwest of Mount Isa, QLD	19
Do.	Leichhardt copper mine (Matrix Metals Ltd., 100%)	110 km northwest of Cloncurry, QLD	10
Do.	Mount Gordon open pit copper (SW-EX) mine (Aditya Birla Minerals Ltd., 100%)	120 kilometers north of Mount Isa, QLD	50
Do.	Mount Isa underground copper-lead-zinc-silver mine (also includes Enterprise, George Fisher, and Hilton Mines) (Xstrata plc, 100%)	Mount Isa, QLD	190
Do.	Mount Lyell underground copper-gold mine [Sterlite Industries (India) Ltd., 100%]	2 km northeast of Queenstown, TAS	35
Do.	Nifty open pit copper (SX-EX) mine (Aditya Birla Minerals Ltd., 100%)	200 km southeast of Marble Bar, WA	25
Do.	Northparkes open pit/underground copper-gold mine (Rio Tinto Ltd., 80%; Sumitomo Metal Mining Oceania Pty. Ltd., 13.3%; SC Mineral Resources Pty. Ltd., 6.7%)	30 km northwest of Parkes, NSW	90
Do.	Olympic Dam underground copper-silver-gold-uranium mine [Olympic Dam Operations Pty. Ltd., operator (BHP Billiton Ltd., 100%)]	Roxby Downs, 80 km north of Woomera, SA	235
Do.	Osborne underground copper-gold mine (Barrick Gold Corp., 100%)	120 km northeast of Boulia, QLD	50
Do.	Peak underground gold-zinc-lead-copper-silver underground mine (includes New Cobar, New Occidental, and Perseverance), (GoldCorp Inc., 100%)	8 km south of Cobar, NSW	3
Do.	Prominent Hill open pit copper-gold mine (OZ Minerals Ltd., 100%)	650 km northwest of Adelaide, SA	100
Do.	Ridgeway underground gold-copper mine (Newcrest Mining Ltd., 100%)	5 km south of Orange, NSW	30
Do.	Rosebery underground zinc-lead-silver-copper-gold mine (OZ Minerals Ltd., 100%)	35 km north of Queenstown, TAS	2
Smelter	Mount Isa copper smelter (Xstrata plc, 100%)	Mount Isa, QLD	250
Do.	Olympic Dam copper smelter [Olympic Dam Operations Pty. Ltd., operator (BHP Billiton Ltd., 100%)]	Roxby Downs, 80 km north of Woomera, SA	70
Do.	Port Kembla copper smelter (Furukawa Co. Ltd., 52.5%; Nittetsu Mining Co., 20%; NissholIwai Corp., 17.5%; Itochu Corp., 10%)	Port Kambla, NSW	120
Refinery	Olympic Dam copper refinery [Olympic Dam Operations Pty. Ltd., operator (BHP Billiton Ltd., 100%)]	Roxby Downs, 80 km north of Woomera, SA	235
Do.	Port Kembla copper refinery (Furukawa Co. Ltd., 52.5%; Nittetsu Mining Co., 20%; NissholIwai Corp., 17.5%; Itochu Corp., 10%)	Port Kambla, NSW	120
Do.	Townsville copper refinery (Xstrata plc, 100%)	Townsville, QLD	300

See footnotes at end of table.

TABLE 2—Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Facilities, major operating companies, and major equity owners	Location of main facilities[1, 2]	Annual capacity[e]
Diamond thousand carats	Argyle Mine (AK-1 lamproite pipe and alluvial diamond mines) (Rio Tinto plc, 100%)	120 km southwest of Kununurra, WA	30,000
Do. do.	Ellendale Mine (includes pipes 4 and 9) (Gem Diamond Ltd., 100%)	130 east southeast of Derby, WA	700
Do. do.	Ellendale 9 North Mine (Blina Diamond NL, 100%)	140 east of Derby, WA	500
Diatomite	Barraba open pit diatomite mine (Australia Diatomite Mining Pty. Ltd., 100%)	85 km north-northwest of Tamworth, NSW	25
Dolomite	Ardrossan metallurgical dolomite quarry (OneSteel Ltd., 100%)	Northern York Peninsula, SA	650
Do.	Cookes Hill Mine (includes Nickol River and Warrawoona) (Haoma Mining NL, 100%)	Near Port Hedland, WA	400
Feldspar	Broken Hill open pit feldspar mine (includes Bakers, Lady Beryl, and Spar Ridge) (Unimin Australia Ltd.., 100%)	42 km southwest of Broken Hill, NSW	15
Garnet	Port Gregory open pit industrial garnet mine (GMA Garnet Pty. Ltd., 100%)	100 km north of Geraldton, WA	250
Gas:			
Condensate thousand 42-gallon barrels per day	North West Shelf gas operations {Woodside Petroleum Pty. Ltd., manager [BHP Petroleum Pty. Ltd., BP Australia Holdings Ltd., Chevron Asiatic Ltd., Japan Australia LNG (MIMI) Pty. Ltd., Shell Development (Australia) Pty. Ltd., and Woodside Petroleum Ltd., 16.67% each]}	130 km offshore Dampier, WA	60
Natural million cubic meters per day	do.	do.	20
Liquefied natural million metric tons	do.	Four-train liquefaction plant, Burrup Peninsula, WA	12
Gold:			
Mine kilograms	Agnew open pit/underground gold mine (Gold Fields Ltd., 100%)	23 km west of Leinster, WA	5,600
Do. do.	Boddington open pit/underground gold mine (Newmont Mining Corp., 66.67%, and AngloGold Ashanti Ltd., 33.33)	100 km southeast of Perth, WA[3]	12,000
Do. do.	Bronzewing underground gold mine (includes Mount McClure, Venus, Success, Cockburn, Corboys, Mount Joel) (Audax Resources Ltd., 100%)	65 km northeast of Leinster, WA	9,000
Do. do.	Cadia Hill open pit gold-copper mine (Newcrest Mining Ltd., 100%)	21 km south-southeast of Orange, NSW	11,000
Do. do.	Ernest Henry open pit copper-gold mine (Xstrata plc, 100%)	35 km northeast of Cloncurry, QLD	3,000
Do. do.	Granny Smith open pit gold mine (includes Wallaby) (Barrick Gold Corp., 100%)	20 km south of Laverton, WA	16,000
Do. do.	Gwalia underground gold mine (St Barbara Ltd., 100%)	3 km south of Leonora, WA	2,600
Do. do.	Henty underground gold-silver mine (Barrick Gold Ltd., 100%)	30 km north of Queenstown, TAS	3,700
Do. do.	Hillgrove Mine (Straits Resources Ltd., 100%)	25 km east of Armidale, NSW	650
Do. do.	Jundee-Nimary open pit/underground gold mine (Newmont Mining Corp., 100%)	45 km northeast of Wiluna, WA	12,000
Do. do.	Kanowna Belle underground gold mine (Barrick Gold Corp., 100%)	18 km northeast of Kalgoorlie, WA	7,000
Do. do.	Lawlers underground gold mine (Barrick Gold Corp., 100%)	30 km southwest of Leinster, WA	3,000
Do. do.	Mount Lyell underground copper-gold mine [Sterlite Industries (India) Ltd., 100%]	2 km northeast of Queenstown, TAS	1,000
Do. do.	Mount Magnet open pit/underground gold mine (includes Hill 50 and Star) (Harmony Gold Mining Co. Ltd., 100%)	2 km from Mount Magnet, WA	8,500
Do. do.	Norseman underground gold mine (Norseman Gold Plc, 100%)	Norseman, WA	3,700
Do. do.	Northparkes open pit/underground copper-gold mine (Rio Tinto Ltd., 80%, and Sumitomo Metal Mining Oceania Pty. Ltd., 20%)	30 km north of Parkes, NSW	155,000
Do. do.	Olympic Dam underground copper-silver-gold-uranium mine [Olympic Dam Operations Pty. Ltd., operator (BHP Billiton Ltd., 100%)]	Roxby Downs, 80 km north of Woomera, SA	1,500
Do. do.	Pajingo underground gold mine (includes Vera-Nancy) [North Queensland Metals Ltd. (operator), 60%; Heemskirk Consolidated Ltd., 40%]	60 km south-southeast of Charters Towers, QLD	6,400
Do. do.	Plutonic open pit/underground gold mine (Barrick Gold Corp., 100%)	180 km northeast of Meekatharra, WA	8,000

See footnotes at end of table.

TABLE 2—Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Facilities, major operating companies, and major equity owners	Location of main facilities[1, 2]	Annual capacity[e]
Gold—Continued:				
Mine—Continued	kilograms	Prominent Hill open pit copper-gold mine (OZ Minerals Ltd., 100%)	650 km northwest of Adelaide, SA	2,200
Do.	do.	Ravenswood open pit mine (includes Nolans, Sarsfield, and Mount Wright) (Resolute Mining Ltd., 100%)	100 km south of Townsville, QLD	3,000
Do.	do.	Ridgeway underground gold-copper mine (Newcrest Mining Ltd., 100%)	25 km south of Orange, NSW	10,800
Do.	do.	Rosebery underground zinc-lead-silver-copper-gold mine (OZ Minerals Ltd., 100%)	35 km north of Queenstown, TAS	1,000
Do.		Saint Ives open pit/underground gold mine (Gold Fields Ltd., 100%)	75 km south-southeast of Kalgoorlie, WA	15,000
Do.	do.	Selwyn underground copper-gold mine (Barrick Gold Corp., 100%)	160 km southeast of Mount Isa, QLD	700
Do.	do.	Stawell underground gold mine (Perseverance Corp. Ltd., 100%)	250 km west of Melbourne, VIC	3,000
Do.	do.	Sunrise Dam open pit mine gold (includes Cleo) (AngloGold Ashanti Ltd., 100%)	55 km south of Laverton, WA	15,000
Do.	do.	Super Pit open pit gold mine (includes Fimiston) [Kalgoorlie Consolidated Gold Mines Pty. Ltd., manager (Barrick Gold Corp., 50%, and Newmont Mining Corp., 50%)]	Southeast corner of the Kalgoorlie-Boulder Township, WA	25,000
Do.	do.	Tanami open pit gold mine (includes Central Desert Joint Venture) (Newmont Gold Corp., 100%)	650 km northwest of Alice Springs, NT	15,000
Do.	do.	Telfer copper and gold mine (Newcrest Mining Ltd., 100%)	400 km east southeast of Port Hedland, WA	15,000
Do.	do.	Thunderbox gold mine (Lionore Mining International Ltd., 100%)	90 km northeast of Leonora, WA	5,000
Do.	do.	Trident gold mine (Avoca Resources Ltd., 100%)	Higginsville, WA	5,000
Do.	do.	Wiluna open pit/underground gold mine (Apex Minerals NL, 100%)	7 km south of Wiluna, WA	3,300
Smelter	do.	Kalgoorlie Consolidated Gold Mines Pty. Ltd., 100%	Gidji Roaster gold smelter, Kalgoorlie, WA	24,300
Refinery	do.	Perth Refinery [AGR Management Services Ltd. (Australian Gold Alliance Pty Ltd., 40%; Western Australian Mint, 40%; and Johnson Matthey (Australian) Ltd., 20%)]	Newburn, WA	300,000
Gypsum		Gypsum Resources Australia Pty. Ltd., 100%	Lake MacDonnell open pit gypsum mine, near Point Thevenard, SA	1,400
Do.		Dampier Salt Ltd., 100%	Lake MacLeod salt and gypsum solar	900
Iron and steel:				
Iron ore		Channar open pit iron ore mine [Hamersley Iron Pty. Ltd., 60% (Rio Tinto Ltd., 100%) and China Iron and Steel Industry & Trade Group Corp. (SINOSTEEL) (a China state-owned company), 40%]	70 km south of Tom Price, WA	11,000
Do.		Cockatoo Island open pit iron ore mine (BHP Billiton Ltd., 100%)	130 km north northeast of Derby, WA	1,500
Do.		Eastern Range open pit iron ore mine [Hamersley Iron Pty. Ltd., 54% (Rio Tinto Ltd., 100%), and Shanghai Baosteel Group Corp., 46%]	10 km east of Paraburdoo, WA	10,000
Do.		Hamersley Operations (includes Brockman No. 2, Marandoo, Mount Tom Price, Nammuldi, Paraburdoo, and Yandicoogina open pit iron ore mines) [Hamersley Iron Pty. Ltd., 100% (Rio Tinto Ltd., 100%)]	30 km to 85 km northeast, northwest, and south of Tom Price, WA	90,000
Do.		Hope Downs Mine [Hope Downs Iron Ore Pty Ltd. (Hancock Prospecting Pty Ltd. 100%), 50% and Rio Tinto Ltd., 50%]	75 km northwest of Newman, WA	30,000
Do.		Jimblebar open pit iron ore mine {[BHP Iron Ore (Jimblebar), 85% (BHP Billiton Ltd., 100%)]; [Mitsui Itochu Iron Pty Ltd., 10% (Mitsui & Co. (Australia) Ltd. 100%)]; [CI Minerals Australia Pty Ltd., 5% (Itochu Corp., 100%)]}	40 km east of Newman, WA	8,000
Do.		Koolyanobbing Central open pit iron ore mine (Portman Ltd., 100%)	50 km north-northeast of Southern Cross, WA	6,000
Do.		Mount Goldsworthy mining associates joint venture (includes Area C, Goldsworthy, and Nimingarra) (BHP Billiton Minerals Pty Ltd., 85%, manager; ITOCHU Minerals & Energy of Australia Pty Ltd., 8%; Mitsui Iron Ore Corp. Pty. Ltd., 7%)	180 km east of Port Hedland, WA	42,000
Do.		Mount Gould open pit iron ore mine (Unimin Australia Ltd., 100%)	160 km west of Meekatharra, WA	6,000
Do.		Mount Newman open pit iron ore mine (includes Mount Whaleback, Orebody 23-25, Orebody 29, and Orebody 30-35) [BHP Billiton Minerals Pty Ltd., 85% (BHP Billiton Ltd., 100%); Mitsui Itochu Iron Pty Ltd., 10% (Mitsui & Co. (Australia) Ltd., 100%); CI Minerals Australia Pty Ltd., 5% (Itochu Corp., 100%)]	Within 13 km of Newman, WA	30,000
Do.		Pannawonica (includes Mesa J) open pit iron ore mine [Robe River Iron Associates, manager (Rio Tinto Ltd., 53%; Mitsui & Co. (Australia) Ltd., 33%; Nippon Steel Australia Pty. Ltd., 10.5%; Sumitomo Metal Australia Pty. Ltd., 3.5%]	130 km south-southwest of Dampier, WA	32,000

See footnotes at end of table.

TABLE 2—Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Facilities, major operating companies, and major equity owners	Location of main facilities[1, 2]	Annual capacity[e]
Iron and steel—Continued:			
Iron ore—Continued	Cloudbreak iron ore mine (includes Chicester Range, Christmas Creek, WhiteKnight, Mount Lewin, Mount Nicholas, and Flinders) (Fortescue Metals Group Ltd., 100%)	Chichester Ranges, East Pilbara, WA	55,000
Do.	Savage River open pit iron ore mine (Stemcor Holdings Ltd., 100%)	100 km southwest of Burnie, TAS	2,400
Do.	Whyalla open pit iron ore mines (OneSteel Ltd., 100%)	270 km northwest of Adelaide, SA	2,600
Do.	Yandi open pit iron ore mine (BHP Billiton Minerals Pty Ltd., 85%, manager; ITOCHU Minerals & Energy of Australia Pty Ltd., 8%; Mitsui Iron Ore Corp. Pty. Ltd., 7%)	92 km north of Newman, WA	42,000
Pig iron	Hismelt pig iron plant [Hismelt Corp. Pty Ltd. (Rio Tinto Ltd., 60%; Nucor Corp., 25%; Mitsubishi Corp., 10%; and Shougang Corp., 5%)]	Kwinana, WA	800
Steel	OneSteel Whyalla steelworks (OneSteel Ltd., 100%)	Whyalla, SA	1,200
Do.	Port Kembla steelworks (Blue Scope Steel Ltd., 100%)	Port Kembla, NSW	5,000
Do.	Smorgon Steel Group Ltd.	Laverton, Melbourne, VIC	700
Do.	do.	Waratch, NSW	285
Kaolin	Axedale Clays open pit kaolin mine (E Clay Pty Ltd., 100%)	18 km east of Bendigo, VIC	50
Do.	Pittong open pit kaolin mine (Imerys Minerals Australia Pty Ltd., 100%)	35 km southwest of Ballarat, VIC	110
Do.	Skardon River open pit kaolin mine (Queensland Kaolin Pty. Ltd., 96.6%, and private, 3.4%)	85 km north of Weipa, QLD	150
Lead:			
Mine, lead content	Broken Hill underground silver-zinc-lead mine (Perilya Ltd., 100%)	Broken Hill, NSW	90
Do.	Cannington underground silver-lead-zinc mine (BHP Billiton Ltd., 100%)	85 km southwest of McKinlay, QLD	265
Do.	Century open pit zinc-silver-lead mine (Zinifex Ltd., 100%)	250 km north of Mount Isa, QLD	90
Do.	Endeavor underground zinc-silver-lead mine (CBH Resources Ltd., 100%)	40 km northwest of Cobar, NSW	45
Do.	Hellyer underground zinc-lead-copper-silver mine (Intec Ltd., 50%, and Polymetals Mining Services Pty Ltd., 50%)	80 km south-southwest of Burnie, TAS	44
Do.	Mount Isa underground copper-lead-zinc-silver mine (also includes Enterprise, George Fisher, and Hilton Mines) (Xstrata plc, 100%)	Mount Isa, QLD	150
Do.	Rosebery underground zinc-lead-silver-copper-gold mine (OZ Minerals Ltd., 100%)	5 km north of Queenstown, TAS	25
Smelter	Mount Isa smelter (Xstrata plc, 100%)	Mount Isa, QLD	240
Do.	Port Pirie smelter (Nyrstar Corp., 100%)	5 km north of Queenstown, TAS	235
Magnesite	Kunwarara open pit magnesite mine (includes Marlborough) (private interest, 100%)	70 km northwest of Rockhampton, QLD	3,000
Manganese:			
Mine, concentrate	Bootu Creek open pit manganese mine (OM Holding Ltd., 100%)	110 km north of Tennant Creek, NT	600
Do.	Groote Eylandt open pit manganese mine [Groote Eylandt Mining Co., operator (BHP Billiton Ltd., 60%, and Anglo American Corp., 40%)]	Groote Eylandt, NT	3,100
Do.	Woodie Woodie open pit manganese mine (includes Bells and East Pilbara leases) [Pilbara Manganese Pty Ltd., operator (Consolidated Minerals Ltd., 100%)]	400 southeast of Port Hedland, WA	1,000
Alloys	Bell Bay Smelter [Tasmanian Electro Metallurgical Co. Pty. Ltd., operator (BHP Billiton Ltd., 100%)]	Bell Bay, TAS	250
Mineral sands	Eneabba open pit heavy-mineral sands mine (Iluka Resources Ltd., 100%)	260 km north of Perth, WA	NA
Do.	Hawks Nest heavy-mineral sands dredge (Mineral Deposits Ltd., 100%)	50 km northeast of Newcastle, NSW	NA
Do.	Jangardup heavy-mineral sands dredge (Cable Sands (WA) Pty. Ltd., 100%)	50 km south of Nannup, WA	NA
Do.	North Capel open pit heavy-mineral sands mine (Iluka Resources Ltd., 100%)	7 km north of Capel, WA	NA
Do.	North Stradbroke Island heavy-mineral sands dredge (Stradbroke Rutile Pty. Ltd., 100%)	35 km east of Brisbane, QLD	NA
Do.	Tiwest Joint Venture heavy-mineral sands dredge (KMCC Western Australia Pty. Ltd., 50%, and Ticor Resources Pty. Ltd., 50%)	180 km north of Perth, WA	NA
Do.	Wemen heavy-mineral sands dredge (Murray Basin Titanium Pty. Ltd., 100%)	80 km southeast of Mildura, VIC	NA

See footnotes at end of table.

TABLE 2—Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Facilities, major operating companies, and major equity owners	Location of main facilities[1, 2]	Annual capacity[e]
Molybdenum	metric tons	Wolfram Camp molybdenum-tungsten mine (Queensland Ore Ltd., 85%, and private, 15%)	85 km west of Cairns, QLD	120
Nickel:				
Mine, Ni content		Avebury nickel mine (includes Bison, North Avebury, Saxon, and West Viking) (OZ Minerals Ltd., 100%)	Near Zeehan, TAS	7
Do.		Black Swan underground nickel mine (includes Silver Swan) (Norilsk Nickel Mining and Metallurgical Co., 100%)	53 km northeast of Kalgoorlie, WA	10
Do.		Carnilya Hill open pit mine (Mincor Resources NL, 70%, and View Resources Ltd., 30%)	25 km northeast of Kambalda, WA	5
Do.		Cawse open pit nickel-cobalt mine (Norilsk Nickel Mining and Metallurgical Co., 100%)	50 km northeast of Kalgoorlie, WA	9
Do.		Cosmos open pit nickel mine (Xstrata plc, 100%)	50 km north of Leinster, WA	13
Do.		Flying Fox underground mine (Western Areas NL , 100%)	108 km south of Marvel Loch, WA	10
Do.		Kambalda underground nickel mines (Palmary Enterprises Ltd., 100%)	5 km south of Kambalda, WA	35
Do.		Lake Johnson underground nickel mine (includes Maggie Hays, Maggie Hays Lake and Emily Ann) (Norilsk Nickel Mining and Metallurgical Co., 100%)	130 km west of Norseman, WA	12
Do.		Lanfranchi underground mine (includes Deacon, Schmitz, Tramway, and Winner) (Panoramic Resources Ltd., 100%)	42 km south of Kambalda, WA	10
Do.		Leinster open pit/underground nickel mines (BHP Billiton Ltd., 100%)	10 km north of Leinster, WA	44
Do.		Long underground mine (Independence Group NL, 100%)	Near Kambalda East, WA	10
Do.		Miitel underground nickel mine (includes Redross and Mariners) (Mincor Resources NL, 100%)	70 km south of Kambalda, WA	10
Do.		Mount Keith open pit nickel mine (includes Cliffs and Yakabindie) (BHP Billiton Ltd., 100%)	70 km south-southeast of Wiluna, WA	40
Do.		Murrin Murrin open pit nickel-cobalt mine (Minara Resources Ltd., 60%, and Glencore International AG, 40%)	60 km east of Leonora, WA	100
Do.		Radio Hill underground nickel-cobalt mine (Fox Resources Ltd., 100%)	35 km south of Karratha, WA	4
Do.		Ravensthorpe open pit mine (BHP Billiton Ltd., 100%)	155 km west of Esperance, WA	50
Do.		Savannah underground mine (Panoramic Resources Ltd., 100%)	120 km north of Halls Creek, WA	8
Do.		Waterloo underground nickel mine (includes Amorac) (Norilsk Nickel Mining and Metallurgical Co., 100%)	90 km north of Leonora, WA	5
Smelter		Kalgoorlie nickel smelter (BHP Billiton Ltd., 100%)	Kalgoorlie, WA	100
Refinery		Kwinana nickel refinery (BHP Billiton Ltd., 100%)	Kwinana, WA	67
Do.		Murrin Murrin nickel refinery (Minara Resources Ltd., 60%, and Glencore International AG, 40%)	Murrin Murrin, WA	45
Do.		Yabulu nickel-cobalt refinery (BHP Billiton Ltd., 100%)	Townsville, QLD	78
Opal		Many small producers	Andamooka and Coober Pedy areas, SA; Lightning Ridge area, NSW	NA
Petroleum	thousand 42-gallon barrels per day	Exxon Mobil Corp., 100%	Altona Refinery, VIC	120
Do.	do.	Bulwer Island Refinery [BP Amoco Refinery (Bulwer Island) Pty. Ltd., 100%]	Bulwer Island, QLD	69.3
Do.	do.	Clyde Refinery [Shell Refining (Australia) Pty. Ltd., 100%]	Clyde, NSW	85
Do.	do.	Geelong Refinery [Shell Refining (Australia) Pty. Ltd., 100%]	Geelong, VIC	110
Do.	do.	Kurnell Refinery (Caltex Australia Ltd., 100%)	Kurnell, NSW	114
Do.	do.	Kwinana Refinery [BP Amoco Refinery (Kwinana) Pty. Ltd., 100%]	Kwinana, WA	138
Do.	do.	Lytton Refinery (Caltex Australia Ltd., 100%)	Lytton, QLD	106
Do.	do.	Port Stanvac Refinery (Exxon Mobil Corp., 100%)	Port Stanvac, SA	69
Phosphate rock		Phosphate Hill-Duchess open pit phosphate mine (Incitec Pivot Ltd., 100%)	140 km northwest of Mount Isa, QLD	2,200
Salt		Dampier solar evaporation salt pans (Dampier Salt Ltd., 100%)	Near Dampier, WA	4,000
Do.		Lake MacLeod solar salt and gypsum evaporation pans (Dampier Salt Ltd., 100%)	65 km north of Carnarvon, WA	900
Do.		Port Hedland solar salt fields (Dampier Salt Ltd., 100%)	Port Hedland, WA	3,000

See footnotes at end of table.

TABLE 2—Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Facilities, major operating companies, and major equity owners	Location of main facilities$^{1, 2}$	Annual capacity^{e}
Silica		Itochu Corp., 50%, and Tochu Corp., 50%	Kemerton silica sands dredge, 25 km northeast of Bunbury, WA	450
Silver:				
Mine, Ag content	kilograms	Broken Hill underground silver-zinc-lead mine (Perilya Ltd., 100%)	Broken Hill, NSW	81,200
Do.	do.	Cannington underground silver-lead-zinc mine (BHP Billiton Ltd., 100%)	85 km southwest of McKinlay, QLD	700,000
Do.	do.	Century open pit zinc-silver-lead mine (OZ Minerals Ltd., 100%)	250 km north of Mount Isa, QLD	3,000
Do.	do.	Pasminco Ltd., 100%	Cockle Creek silver smelter, NSW	85,000
Do.	do.	Endeavor underground zinc-silver-lead mine (CBH Resources Ltd., 100%)	40 km northwest of Cobar, NSW	35,000
Do.	do.	Hellyer underground zinc-lead-copper-silver mine (Intec Ltd., 50%, and Polymetals Mining Services Pty Ltd., 50%)	80 km south-southwest of Burnie, TAS	60,000
Do.	do.	Henty underground gold-silver mine (Barrick Gold Ltd., 100%)	30 km north of Queenstown, TAS	1,100
Do.	do.	Mount Isa underground copper-lead-zinc-silver mine (also includes Enterprise, George Fisher, and Hilton Mines) (Xstrata plc, 100%)	Mount Isa, QLD	375,000
Do.	do.	Olympic Dam underground copper-silver-gold-uranium mine [Olympic Dam Operations Pty. Ltd., operator (BHP Billiton Ltd., 100%)]	Roxby Downs, 80 km north of Woomera, SA	27,000
Do.	do.	Peak underground gold-zinc-lead-copper-silver underground mine (includes New Cobar, New Occidental, and Perseverance), (GoldCorp Inc., 100%)	8 km south of Cobar, NSW	6,000
Do.	do.	Rosebery underground zinc-lead-silver-copper-gold mine (OZ Minerals Ltd., 100%)	5 km north of Queenstown, TAS	35,000
Smelter	do.	Port Pirie smelter (Nyrstar Corp., 100%)	5 km north of Queenstown, TAS	450,000
Refinery	do.	Perth Refinery [AGR Management Services Ltd. (Australian Gold Alliance Pty Ltd., 40%; Western Australian Mint, 40%; and Johnson Matthey (Australian) Ltd., 20%]	Newburn, WA	81,000
Spodumene		Greenbushes open pit/underground tantalite-spodumene mine (Talison Minerals Pty Ltd., 100%)	70 km southeast of Bunbury, WA	150
Talc		Three Springs open pit talc mine (Rio Tinto Ltd., 100%)	330 km north of Perth, WA	150
Tantalum, tantalite, Ta_2O_5	metric tons	Greenbushes open pit/underground tantalite-spodumene mine (Talison Minerals Pty Ltd., 100%)	70 km southeast of Bunbury, WA^{3}	550
Do.	do.	Bald Hill tantalite mine (Haddington Resources Ltd., 100%)	60 km southeast of Kambalda, WA^{3}	100
Do.	do.	Wodgina open pit tantalite mine (Talison Minerals Pty Ltd., 100%)	70 km southeast of Bunbury, WA^{3}	250
Tin:				
Mine, Sn content	do.	Collingwood underground tin mine (Metals X Ltd., 100%)	35 km south of Cooktown, QLD	3,000
Do.	do.	Greenbushes open pit/underground tantalite-spodumene mine (Talison Minerals Pty Ltd., 100%)	70 km southeast of Bunbury, WA^{3}	1,000
Do.	do.	Renison Bell underground tin mine (Metals X Ltd., 100%)	136 km south of Burnie, TAS^{3}	4,000
Smelter	do.	Greenbushes Smelter (Talison Minerals Pty Ltd., 100%)	70 km southeast of Bunbury, WA	1,000
Tungsten, W content	do.	Kara magnetite and scheelite mine (Itochu Corp., 50%, and Tasmania Mines Ltd., 50%)	30 km south of Burnie, TAS	50
Do.	do.	Wolfram Camp molybdenum-tungsten mine (Queensland Ore Ltd., 85%, and private, 15%)	85 km west of Cairns, QLD	500
Uranium, U_3O_8 content	do.	Beverley in situ leach uranium operation (Heathgate Resources Pty. Ltd., 100%)	300 km northeast of Port Augusta, SA	1,000
Do.	do.	Olympic Dam underground copper-silver-gold-uranium mine [Olympic Dam Operations Pty. Ltd., operator (BHP Billiton Ltd., 100%)]	Roxby Downs, 80 km north of Woomera, SA	4,400
Do.	do.	Ranger open pit uranium mine (Energy Resources of Australia Ltd., 100%)	230 km east of Darwin, NT	5,000
Vanadium, V_2O_5	do.	Windimurra open pit mine vanadium (Precious Metals Australia Ltd., 90%, and Noble Group Ltd., 10%)	100 km east-southeast of Mount Magnet, WA	8

See footnotes at end of table.

TABLE 2—Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Facilities, major operating companies, and major equity owners	Location of main facilities[1, 2]	Annual capacity[e]
Zinc:			
Mine, Zn content	Broken Hill underground silver-zinc-lead mine (Shenzhen Zhongjin Lingnan Nonfemet Co. Ltd., 50.1%, and Perilya Ltd., 49.9%)	Broken Hill, NSW	360
Do.	Cannington underground silver-lead-zinc mine (BHP Billiton Ltd., 100%)	85 km southwest of McKinlay, QLD	100
Do.	Century open pit zinc-silver-lead mine (OZ Minerals Ltd., 100%)	250 km north of Mount Isa, QLD	500
Do.	Endeavor underground zinc-silver-lead mine (CBH Resources Ltd., 100%)	40 km northwest of Cobar, NSW	125
Do.	Golden Grove underground zinc-copper mine (OZ Minerals Ltd., 100%)	225 km east of Geraldton, WA	150
Do.	Hellyer underground zinc-lead-copper-silver mine (Intec Ltd., 50%, and Polymetals Mining Services Pty Ltd., 50%)	80 km south-southwest of Burnie, TAS	130
Do.	Jaguar underground mine (Jabiru Metals Ltd., 100%)	250 km north of Kalgoorlie, WA	420
Do.	McArthur River open pit mine [McArthur River Mining Pty Ltd., operator (Xstrata plc, 100%)]	60 km southwest of Borroloola, NT	143
Do.	Mount Isa underground copper-lead-zinc-silver mine (also includes Enterprise, George Fisher, and Hilton Mines) (Xstrata plc, 100%)	Mount Isa, QLD	175
Do.	Peak underground gold-zinc-lead-copper-silver underground mine (includes New Cobar, New Occidental, and Perseverance), (GoldCorp Inc., 100%)	8 km south of Cobar, NSW	8
Do.	Rosebery underground zinc-lead-silver-copper-gold mine (OZ Minerals Ltd., 100%)	35 km north of Queenstown, TAS	100
Smelter	Port Pirie smelter (Nyrstar Corp., 100%)	5 km north of Queenstown, TAS	45
Do.	Hobart smelter (OZ Minerals Ltd., 100%)	Hobart, TAS	320
Refinery	Sun Metals zinc refinery [Sun Metals Corp. Pty. Ltd., operator (Korea Zinc Co., 100%)]	Townsville, QLD	170

[e] Estimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto. NA Not available.

[1] Abbreviations for States and Territories in this table include the following: NSW—New South Wales; NT—Northern Territory; QLD—Queensland; SA—South Australia; TAS—Tasmania; VIC—Victoria; WA—Western Australia.

[2] Abbreviation(s) used for unit(s) of measure in this table include the following: km—kilometer.

[3] Care and maintenance; expansion project development decision pending.

TABLE 3
AUSTRALIA: RESERVES OF MAJOR MINERAL COMMODITIES IN 2008

Commodity		Reserves[1]
Antimony, Sb content	thousand metric tons	136
Bauxite	million metric tons	6,200
Cadmium, Cd content	thousand metric tons	61
Coal:		
Black:		
In situ	billion metric tons	56
Recoverable	do.	39
Brown:		
In situ	do.	44
Recoverable	do.	37
Cobalt, Co content	thousand metric tons	1,500
Copper, Cu content	million metric tons	78
Diamond:		
Gem and near gem	million carats	92
Industrial	do.	96
Gold, Au content	metric tons	6,260
Iron ore	billion metric tons	24
Lead, Pb content	million metric tons	27
Lithium, Li content	thousand metric tons	584
Magnesite ($MgCO_3$ content)	million metric tons	344
Manganese ore	do.	181
Mineral sands:		
Ilmenite	do.	212
Rutile	do.	23
Zircon	do.	39
Molybdenum, Mo content	thousand metric tons	225
Nickel, Ni content	million metric tons	26
Niobium (columbium) and tantalum:		
Niobium (columbium), Nb content	thousand metric tons	115
Tantalum, Ta content	do.	51
Petroleum, recoverable:		
Condensate	million barrels	2,750
Crude	do.	1,430
Liquefied petroleum gas	do.	1,470
Natural gas	billion cubic meters	4,650
Platinum-group metals (Pd, Pt)	metric tons	19
Rare earths (REO plus Y_2O_3)	thousand metric tons	1,650
Silver, Ag content	do.	61
Tin, Sn content	do.	145
Tungsten, W content	do.	111
Uranium, U content	do.	1,160
Vanadium	do.	1,750
Zinc	million metric tons	53

do. Ditto.

[1] Economic Demonstrated Resources.

Source: Geoscience Australia, 2009, Australia's identified mineral resources 2009: Canberra, Australia, Geoscience Australia, p. 5. (Data have been rounded to no more than three significant digits.)

THE MINERAL INDUSTRY OF BANGLADESH

By Yolanda Fong-Sam

In 2008, the mineral industry of the People's Republic of Bangladesh was based mainly on the production of coal, granite, natural gas, and petroleum. The country lacks reserves of metallic minerals, but has a large potential for the discovery of natural gas. During 2008, the Bangladesh Oil, Gas and Mineral Corp. (Petrobangla), which is the Government entity that is responsible for the exploration for, production of, and distribution of natural gas countrywide, was actively performing exploratory drillings and conducting three-dimensional (3-D) seismic surveys in an attempt to discover new gasfields to increase the country's natural gas reserves. Petrobangla was also in charge of the development of economically feasible mineral deposits in the country whereas exploring for minerals was the responsibility of the Geological Survey of Bangladesh (Bangladesh Oil, Gas and Mineral Corp., 2008, p. 8, 17).

Production

Bangladesh produced small amounts of industrial minerals and processed products, which included cement, clay, limestone, nitrogen fertilizer, and salt. Eastern Refinery Ltd. (ERL), which was a subsidiary of Bangladesh Petroleum Corp. (BPC), was Bangladesh's sole petroleum refining company. The refinery, which was located in Chittagong, processed imported crude oil from which it produced petroleum products (Eastern Refinery Ltd., 2009).

Structure of the Mineral Industry

In addition to exploring for, producing, and distributing oil and gas, Petrobangla also explored for and produced coal and granite through its subsidiaries Barapukuria Coal Mining Co. Ltd., and Maddhapara Granite Mining Co. Ltd. Table 2 is a list of major mineral industry facilities.

Commodity Review

Industrial Minerals

Cement.—Lafarge Surma Cement Ltd., which was a joint venture of Cementos Molins S.A. of Spain and Lafarge Group of France, operated a plant located at Chhatak in the district of Sunamganj in northeastern Bangladesh. Lafarge Surma mined the raw material that fed the plant from its own quarry at East Khasi Hills in Meghalaya State, India. Materials from the quarry were transported 17 kilometers (km) across the border from India to Bangladesh by conveyor belt. Lafarge Surma commenced commercial production at the plant in October 2006 with an annual production capacity of 1.5 million metric tons (Mt) of cement and 1.15 Mt of clinker; this level of cement production represented about 10% of the domestic cement market. In 2008, the Lafarge Surma cement plant operated below full capacity after a disruption in the supply of limestone in 2007 halted operations at the plant. The supply disruption was owing to a court injunction concerning a dispute in the land use classification of the quarry facility in India. Lafarge Surma expected the consumption of cement in Bangladesh to increase in the near future owing to the Government's plan to develop new infrastructure (Lafarge Surma Cement Ltd., 2009; LankaBangla Securities, 2009).

HeidelbergCement Bangladesh Ltd., which was a subsidiary of HeidelbergCement Group of Germany, operated two plants in Bangladesh. The plants were located in Chittagong and in the Kanchpur area of Narayangonj. In February, the company completed the installation of a second cement grinding unit with an annual capacity of 450,000 metric tons (t) at its Kanchpur plant, which increased HeidelbergCement Bangladesh's total annual capacity to 2 Mt of cement (LankaBangla Securities, 2008).

Stone, Crushed.—Maddhapara Granite was the Petrobangla subsidiary responsible for the production of granite at its underground mine in the District of Dinajpur. The facility had a capacity to produce about 1.65 million metric tons per year (Mt/yr) of hard rock. The Maddhapara Mine commenced partial commercial production in May 2007. In fiscal year 2007-08 (which runs from July 1 to June 30), the mine produced 258,516 t of stone, of which about 50%, or 128,978 t, was sold domestically for use as construction material, such as aggregates (Bangladesh Oil, Gas and Mineral Corp., 2008, p. 29; Maddhapara Granite Mining Co. Ltd., 2009).

Mineral Fuels

Coal.—The Barapukuria coal mine, which was managed by Barapukuria Coal Mining Co. Ltd. (BCMCL) (a subsidiary of Petrobangla), was the first and only operating coal mine in Bangladesh. The mine reported a total production of 677,000 t of coal in fiscal year 2007-08, which was 50% more than the production target of 450,000 t. The increase in production was mainly owing to stock production from previous years. Coal produced from the mine was being used for power generation in the 250-megawatt coal-fired thermal powerplant located near the mine in the District of Dinajpur. Coal sales for fiscal year 2007-08 reached 491,000 t (Bangladesh Oil, Gas and Mineral Corp., 2008, p. 28-29).

In 2008, the London-based company Global Coal Management Resources (GCM) was still awaiting the approval from the Government for the development of its Phulbari Coal Project, which is located in the northwest region of Phulbari. The Government was in the process of reviewing the country's coal policy, which would set the regulations for the development of the coal industry and help establish a reliable source of energy for the country through the use of coal as the primary fuel for power generation (Global Coal Management Resources, 2008, p. 6-7, 9).

Natural Gas.—Petrobangla started to carry out extensive exploration and drilling activities to increase gas reserves, given that natural gas was used to produce approximately 73% of the commercial energy in Bangladesh. Petrobangla estimated that natural gas reserves would last through 2011 before the demand exceeded supply, based on 2008 gas demand rates. As of yearend 2008, 23 gasfields had been discovered in the country for an estimated proven recoverable reserve of more than 441 billion cubic meters (reported as 15.584 trillion cubic feet) (Bangladesh Oil, Gas and Mineral Corp., 2008, p. 8).

The Titas gasfield was the largest gasfield in the country and supplied about 24% of the country's total requirements for natural gas. The gasfield was operated by Bangladesh Gas Fields Co. Ltd. (BGFCL), which was a subsidiary of Petrobangla. The Sangu gasfield, which was Bangladesh's only offshore gasfield, is located in the Bay of Bengal and produced 4.8 million cubic meters per day (reported as 170 million cubic feet per day) in 2005, which by December 2008, had subsided to 1.4 million cubic meters per day (reported as 50 million cubic feet per day). The Bibiyana field came into production in March 2007 with a production rate of 5.7 million cubic meters per day (reported as 200 million cubic feet per day), which increased to more than 18.4 million cubic meters per day (reported as 650 million cubic feet per day) by mid-2008. The Bibiyana gasfield supplied about 23% of the total gas demand in the country (Bangladesh Oil, Gas and Mineral Corp., 2008, p. 9).

Public sector activities in oil and gas exploration, production, and distribution, and the development of the mineral industry in Bangladesh were managed through Petrobangla's 11 specialized companies. In 2008, Petrobangla's Bangladesh Petroleum Exploration and Production Co. Ltd. (BAPEX) was the only company that conducted exploration for oil and gas in the country. In addition, BAPEX carried out production activities at its properties, which included the Fenchuganj and the Saldanadi gasfields, for a total production of about 307.8 million cubic meters of natural gas (reported as 10.9 billion cubic feet) in fiscal year 2007-2008 (Bangladesh Oil, Gas and Mineral Corp., 2008, p. 18, 20).

In fiscal year 2007-08, the major natural gas producing companies in the public sector were Petrobangla companies BGFCL and Sylhet Gas Fields Ltd. (SGFL), which together accounted for about 53% of total gas production. BGFCL was the leading gas producing company in Bangladesh, and managed the following six gasfields: Bakhrabad, Habigangj, Kamta, Meghna, Narsingdi, and Titas. BGFCL produced about 7.198 billion cubic meters (reported as 254.2 billion cubic feet) in fiscal year 2007-08. In the public sector, SGFL was the second ranked gas producer in the country and operated the Beanibazar, the Haripur, the Kailashtila, and the Rashidpur gasfields. In fiscal year 2007-08, SGFL produced about 1.741 billion cubic meters (reported as 61.5 billion cubic feet) of gas (Bangladesh Oil, Gas and Mineral Corp., 2008, p. 18, 22-23).

Five companies under Petrobangla carried out gas transmission and distribution in Bangladesh. In fiscal year 2007-08, the Gas Transmission Co. Ltd. had a total of 930 km of gas pipeline and transported 12.3 billion cubic meters of gas. In 2008, Titas Gas Transmission and Distribution Co. Ltd. (TGTDCL) constructed about 600 km of distribution pipelines for a total network of 11,140 km. TGTDCL sold approximately 12.2 billion cubic meters of gas (reported as 432.4 billion cubic feet) in fiscal year 2007-08, from which 42% was sold to the powerplant sector and 9% was sold to the fertilizer industry. In fiscal year 2007-08, Bakhrabad Gas System Ltd. (BGSL) constructed 227.4 km of new distribution pipeline for a total network of 6,092 km. The company sold 2.8 billion cubic meters of gas (reported as 99.8 billion cubic feet), from which 21% was sold to the powerplant sector and 34% was sold to the fertilizer industry. In the same timeframe, Jalalabad Gas Transmission and Distribution System Ltd. constructed 140 km of gas distribution and service pipelines for a total network of 2,890 km of transmission, distribution, and service lines. Gas sold in fiscal year 2007-08 amounted to about 884.6 million cubic meters (reported as 31.24 billion cubic feet), from which approximately 47% was sold to the powerplant sector. Similarly, Pashchimanchal Gas Co. Ltd. had a total network of 887.8 km of pipeline and sold 613.6 million cubic meters (reported as 21.67 billion cubic feet) in fiscal year 2007-08 (Bangladesh Oil, Gas and Mineral Corp., 2008, p. 23-26).

During fiscal year 2007-08, four international companies operated and produced gas in Bangladesh, including Tullow Oil plc of the United Kingdom (698.9 million cubic meters), Cairn Energy plc of the United Kingdom (671.1 million cubic meters), Niko Resources Ltd. of Canada (52.95 million cubic meters), and Chevron Corp. of the United States (5.08 billion cubic meters) (Bangladesh Oil, Gas and Mineral Corp., 2008, p. 30).

Petroleum.—In 2008, ERL produced about 15 petroleum products and supplied about 40% of the country's petroleum products needs. ERL processed crude oil imported by BPC and produced petroleum products that were transferred to other BPC subsidiaries for marketing and distribution (Eastern Refinery Ltd., 2009).

Outlook

Mineral exploration in Bangladesh is expected to increase during fiscal year 2009-10 as a result of projects that started and progressed in 2008, especially in the mineral fuels sector. The Government of Bangladesh has a goal of having the entire country with a dependable power supply by 2020. When completed, the final review of the coal policy will set the regulations for the development of the coal industry. Bangladesh is considering coal as an alternative to natural gas as a reliable supply of energy when used as a primary fuel for power generation. This is particularly important as the country made no new significant natural gas discoveries in 2008, although Petrobangla carried out extensive exploration and drilling activities to increase gas reserves. Lafarge expects the consumption of cement to increase in the near future owing to the development of new infrastructure by the Government (Bangladesh Oil, Gas and Mineral Corp., 2008, p. 8, 35).

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TABLE 1
BANGLADESH: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
Cement, hydraulic[4]		5,000,000	5,100,000	5,100,000	5,100,000	5,000,000
Clays, kaolin[4]		8,300	8,400	8,500	8,600	8,500
Coal, bituminous[4]		87,143 [r, 5]	303,016 [r, 5]	388,000 [r]	677,000 [r]	700,000
Gas, natural, marketed[4, 6]	million cubic meters	13,605 [r, 5]	14,915 [r, 5]	15,918 [r, 5]	17,014 [r, 5]	18,516 [5]
Iron and steel, metal:[4]						
Steel, crude, ingot only		25,000	20,000	10,000	--	--
Steel products		70,000	70,000	70,000	60,000	60,000
Nitrogen, N content of urea, ammonia, ammonium sulfate		1,379,500 [5]	1,380,000	1,250,000	1,300,000	1,300,000
Petroleum:						
Crude	thousand 42-gallon barrels	1,700	1,663 [r, 5]	1,715 [r, 5]	1,800 [r]	1,800
Refinery products	do.	9,100	9,200	9,300	9,400	9,500
Salt, marine[4]		350,000	350,000	350,000	360,000	360,000
Stone, crushed						
Granite		650,000	900,000	1,200,000	1,500,000	1,500,000
Limestone		36,000	35,179 [r, 5]	67,736 [r, 5]	70,000 [r]	70,000

[r] Revised. do. Ditto. -- Zero.

[1] Estimated data are rounded to no more than three significant digits.

[2] Table includes data available through December 28, 2009.

[3] In addition to the commodities listed, crude construction materials, such as sand and gravel and other varieties of stone, presumably are produced, but available information is inadequate to make reliable estimates of output.

[4] Data are for fiscal year ending June 30 of following year.

[5] Gross production is not reported; the quantity vented, flared, or reinjected is believed to be negligible.

[6] Reported figure.

TABLE 2
BANGLADESH: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity^e
Cement		Bangladesh Oil, Gas and Mineral Corp. (Petrobangla)	Chittagong	1,000.
Do.		do.	Sylhet	1,100.
Do.		Cemex Cement Bangladesh Ltd.	Mahmudnagar	600.
Do.		HeidelbergCement Bangladesh Ltd.	Chittagong and Narayangonj (near the capital Dhaka)	2,000.
Do.		Holcim (Bangladesh) Ltd.	Bagerhat and Narayanganj	1,300.
Do.		Lafarge Surma Cement Ltd. (Lafarge Group and Cementos Molins S.A.)	Chhatak, Sunamganj	1,500 (1,150 clinker).
Do.		Premier Cement Mills Ltd.	Muktarpul and Munshiganj	1,460.
Do.		Shah Cement Industries Ltd.	Dhaka	1,860.
Do.		Unique Cement Industries Ltd.	Chittagong, Dhaka, and Sylhet	1,440.
Coal		Barapukuria Coal Mining Co. Ltd. (BCMCL) [Bangladesh Oil, Gas and Mineral Corp. (Petrobangla), 100%]	Barapukuria	1,000.
Fertilizer		Bangladesh Chemical Fertilizer Corp.	Auganish	560.
Do.		do.	Fenchugani	100.
Do.		do.	Ghorasai	600.
Gas, natural	million cubic meters per day	Bangladesh Gas Fields Co. Ltd. (BGFCL) [Bangladesh Oil, Gas, and Mineral Corp. (Petrobangla), 100%]	Bakhrabad, Habigangj, Kamta, Meghna, Narsingdi, and Titas	22.
Do.	do.	Bangladesh Petroleum Exploration and Production Co. Ltd. (BAPEX) [Bangladesh Oil, Gas and Mineral Corp. (Petrobangla), 100%]	Fenchuganj and Saldanadi	2.
Do.	do.	Cairn Energy plc	Sangu (offshore)	3.
Do.	do.	Chevron Corp.	Bibiyana, Jalalabad, and Maulavi Bazar	17.
Do.	do.	Niko Resources Ltd.	Bibiyana and Feni	6.
Do.	do.	Sylhet Gas Fields Ltd. (SGFL) [Bangladesh Oil, Gas, and Mineral Corp. (Petrobangla), 100%]	Beanibazar, Haripur, Kailashtila, and Rashidpur	5.
Do.	do.	Tullow Oil plc	Bangora	2.
Petroleum:				
Crude	42-gallon barrels per day	Cairn Energy plc	Sangu	30,000.
Refined	do.	Eastern Refinery Ltd. (ERL)	Chittagong	34,000.
Steel, crude		Bangladesh Steel and Engineering Corp.	do.	20.
Stone, crushed, granite		Maddhapara Granite Mining Co. Ltd. [Bangladesh Oil, Gas and Mineral Corp. (Petrobangla)]	Maddhapara, District of Dinajpur	1,650.

^{e}Estimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto.

THE MINERAL INDUSTRIES OF BHUTAN AND NEPAL

By Lin Shi

BHUTAN

Although the mineral sector of Bhutan was small, and insignificant to the country's economy, Bhutan is endowed with rich mineral resources that have allowed the sustainable growth of a mineral-based industry and exports. Mining and value-added processing have helped generate employment and contributed to alleviating some of the country's poverty. Bhutan's mineral industry was characterized by the production of cement, coal, dolomite, ferrosilicon, graphite, and limestone. The exploitation of Bhutan's large hydroelectric power resources has enabled the development of several small local cement operations.

Production

The value of the country's mining sector grew at a rate of 23.3% in 2007 (the latest year for which data were available), which was the largest annual rate increase in the past 5 years. The increase was probably a result of the increased mineral commodity prices. Jigme Mining Corp. Ltd. mined dolomite at Gomtu, a graphite processing plant operated at Paro Dzong, and marble and slate were quarried for use as dimension stone. The output level of these mineral commodities remained steady in 2007 (table 1). Dolomite, ferrosilicon, and gypsum were exported mainly to India. Bhutan Ferro Alloys Ltd. (BFAL), which was a joint venture of the Government, Marubeni Corp. of Japan, and local Tashi Commercial Corp., produced ferrosilicon at Phuentsholing. Deposits of beryl, copper, lead, mica, pyrite, tin, tungsten, and zinc were reported to have been found in Bhutan (table 2; World Bank, The, 2009, p. 3).

Structure of the Mineral Industry

The manufacturing industry of Bhutan was dominated by a small number of major operators, including BFAL, Bhutan Agro Industries Ltd., Bhutan Board Products Ltd., Bhutan Carbide and Chemicals Ltd., and Penden Cement Plant. In addition, a number of other small manufacturing plants were operating in various parts of Bhutan (Bhutan 2008, 2008).

The Department of Geology and Mines has the primary responsibility for geologic mapping, exploring for additional mineral deposits, and managing the mineral resources of the country. It is also responsible for registering mineral titles and managing mineral and mining data. In addition, the Department conducts geologic investigations of slope stability, performs foundation risk assessments of glacial lake outburst floods, monitors glaciers and glacial lakes, and carries out seismic studies. The Department of Energy is responsible for the country's hydroelectric power development. Energy production from Bhutan's abundant hydroelectric power resources has provided a significant boost to the country's economy in recent years (Ministry of Economic Affairs, 2009).

Commodity Review

Metals

Ferroalloys.—BFAL, which was the leading private company in Bhutan, consistently produced ferrosilicon at a rate of about 21,000 metric tons per year (t/yr); silica fume, at about 4,200 t/yr; and magnesium ferrosilicon, at about 2,400 t/yr. Most of these products were exported to India, but some quantities of ferrosilicon and micro silica were exported to China, Japan, Singapore, and the United States. India was Bhutan's leading trading partner and a major investor; the two countries' relationship was considered to be critical for the development of the Bhutan's economy. India imported an average of 30,000 t/yr of ferrosilicon from Bhutan, and demand for ferrosilicon continued to increase in India. BFAL took steps to market magnesium ferrosilicon (a value-added product) to the international market (Bhutan Ferro Alloys Ltd., 2009).

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NEPAL

Mining and quarrying contributed less than 1% of the Nepal's total real gross domestic product (GDP), and its mineral resources were mostly undeveloped. The country possesses some deposits of cobalt, copper, iron ore, lead, limestone, magnesite, mica, and zinc. A lead and zinc deposit is located near Lari in the Ganesh Himal region (U.S. Department of State, 2009).

In 2008, the country voted in a Constituent Assembly, named a President, elected a Prime Minister, and formed a coalition government, which produced a draft development strategy to support the country's peace-building agenda for the next 3 years (U.S. Department of State, 2009).

Production

The growth rate of Nepal's real GDP in 2008 was 4.7%, compared with 3.2% in 2007 when the country returned to peace following a 10-year Maoist insurgency that resulted in the signing of a comprehensive peace agreement in 2006. In 2008, Nepal produced cement, red clay, coal, limestone, marble, quartz crystal and tourmaline, quartzite, salt, rolled steel, and talc. The production of some mineral commodities, such as lignite, lime, marble, salt, and tourmaline, ceased or was only intermittent owing to exhaustion of reserves (table 1; U.S. Department of State, 2009).

Structure of the Mineral Industry

The Department of Mines and Geology under the Ministry of Industry, Commerce, and Supplies is responsible for conducting geoscientific research, carrying out exploration, evaluating mineral and energy resources, and promoting mineral-based industries. Hetauda Cement Industries Ltd., which was located at Makawanpur, and Himal Cement Co. Ltd., which was located at Chobhar, were the country's primery cement producers (table 2).

Commodity Review

Mineral Fuels and Other Sources of Energy

Renewable Energy.—Only about 1% of Nepal's hydroelectric potential was currently being tapped. The Department of Electricity Development had invited global tenders for the 600-megawatt (MW) Budhi Gandi project in December 2007, but the invitation failed to attract investors. In March 2008, the 402-MW Arun III hydroelectric project was awarded to India's state-owned Sutlej Jal Vidyut Nigam (SJVN). The domestic demand for electricity was increasing at a rate of 8% to 10% per year (U.S. Department of State, 2009).

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TABLE 1
BHUTAN AND NEPAL: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Country and commodity[2]		2004	2005	2006[e]	2007	2008[e]
BHUTAN						
Cement[e]		170,000	170,000	180,000	180,000	180,000
Coal, bituminous		29,631	85,279	82,000	105,261 [r]	123,704 [3]
Dolomite		452,336	388,711	410,000	578,552 [r]	1,247,568 [3]
Ferrosilicon[e]		21,147 [3]	20,000	20,000	21,000	36,600
Granite	square meters	200	877	900	1,341 [r]	199 [3]
Gypsum		131,236	150,585	160,000	189,198 [r]	248,445 [3]
Iron ore, gross weight		--	5,679	5,300	-- [r]	-- [3]
Limestone		560,807	536,030	550,000	543,964 [r]	583,707 [3]
Marble	square meters	314	372	480	1,121 [r]	1,143 [3]
Quartzite		42,599	52,694	50,000	64,049 [r]	94,688 [3]
Shale, green and pink		--	363	450	-- [r]	-- [3]
Slate	square meters	11,779	270	560	7,256 [r]	764 [3]
Stone		246,508	146,767	120,000	388,721 [r]	408,945 [3]
Talc		39,797	42,791	45,000	62,015 [r]	56,077 [3]
NEPAL						
Cement[e]		285,000	290,000	295,000	300,000	295,000
Clay, red		29,234	35,484	34,000	35,000 [e]	34,000
Coal:						
Bituminous		10,459	9,259	11,963 [3]	16,274	16,300
Lignite		58	30	--	98	--
Total		10,517	9,289	11,963 [3]	16,372	16,300
Gemstones:						
Quartz	kilograms	1,215	1,092	1,100	1,110 [e]	1,110
Tourmaline	do.	--	7	7	5 [e]	--
Total	do.	1,215	1,099	1,107 [3]	1,115	1,110
Magnesia, dead-burned		50	56	--	--	--
Salt	thousand metric tons	4	2	--	2 [e]	--
Steel, rolled[e]		95,000	90,000	90,000	85,000	85,000
Stone:						
Limestone		388,109	263,701	402,130 [3]	822,042	822,000
Marble:						
Chips		481	436	384 [3]	954	954
Slab, cut	square meters	56,014	23,850	28,110 [3]	22,110	22,100
Craggy	do.	728	--	--	--	--
Quartzite[e]		2,900	3,000	3,000	3,100	3,000
Talc		3,435	5,832	6,648 [3]	9,043	9,040

[e] Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r] Revised. do. Ditto. -- Zero.

[1] Table includes data available through July 1, 2009.

[2] In addition to the commodities listed, crude construction materials, such as sand and gravel and a variety of stone, presumably are produced in Bhutan and Nepal, but information is inadequate to make reliable estimates of output.

[3] Reported figure.

TABLE 2
BHUTAN AND NEPAL: STRUCTURE OF THE MINERAL INDUSTRIES IN 2008

(Thousand metric tons unless otherwise specified)

Country and commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
BHUTAN				
Cement		Penden Cement Authority Ltd.	Gomtu, Samtse District	100
Dolomite		Jigme Mining Corp. Ltd.	do.	900
Ferrosilicon		Bhutan Ferro Alloys Ltd.	Phuentsholing	34
NEPAL				
Cement		Hetauda Cement Industries Ltd.	Makawanpur	260
Do.		Himal Cement Co. Ltd.	Chobhar	130
Lead and zinc		Nepal Metal Co. Ltd.	Lari	NA
Magnesite	metric tons	Nepal Orind Magnesite Ltd.	Dolkha	50
Marble		Godavari Marble Industries Ltd.	Latitpur	NA

[e] Estimated. Do., do. Ditto. NA Not available.

THE MINERAL INDUSTRY OF BURMA

By Yolanda Fong-Sam

In 2008, Burma, also known as Myanmar, produced a variety of mineral commodities, including cement, coal, copper, lead, natural gas, petroleum, petroleum products, precious and semiprecious stones, tin, tungsten, and zinc.

Production

On May 2, 2008, tropical storm Nargis caused extensive damage, especially in southwestern Burma, and flooding as much as 50 kilometers (km) inland. The storm was considered the worst natural disaster in the recorded history of the country. During 2008, most of Burma's mining sector experienced a significant decline in mineral production. Copper production decreased by about 54%; spinel production, by 32%; coal, 12%; crude petroleum, 5%; and petroleum products, 4.6%. On the other hand, significant increases in production were reported for zinc (100%) and sapphire (86%). Other mineral commodities for which production increases were reported were jade (54.5%), ruby (34%), refined lead (22.4%), and cement (11%) (table 1; Thaindian News, 2009). Burma's sole copper mine (the Monywa copper project) halted operations in April 2008 for undisclosed reasons. Operations were expected to restart in the second quarter of 2009 (Intellasia.net, 2009).

Mineral Trade

Burma's total trade value for 2008 was \$11.32 billion,[1] of which exports represented \$7 billion, and imports, \$4.3 billion, or the equivalent of 61.8% and 38.2% of total trade, respectively. The total value of exports increased by about 11% compared with the total value in 2007 of \$6.3 billion, and that of imports increased by about 30% compared with the total value in 2007 of \$3.3 billion (Central Statistical Organization, 2009, p. 1, 50).

In 2008, the value of natural gas exports was approximately \$2.45 billion, which represented 35% of total exports and a decrease of 8.3% compared with the value in 2007. The principal mineral commodities imported by Burma in 2008 were cement, which was valued at \$25.4 million compared with \$24.1 million in 2007 (a modest increase of about 5%); coal and coke, which together were valued at \$2.47 million compared with \$6.7 million in 2007; and base metals and manufactures, which were valued at \$272.3 million compared with \$221.5 million in 2007 (an increase of about 23%) (Central Statistical Organization, 2009, p. 5-7, 16).

Thailand was Burma's main export partner in 2008 followed by Singapore and India. Total Burmese exports to Thailand were valued at \$2.62 billion (about 37.4% of the country's total exports); exports to Singapore were valued at \$883.5 million (12.6% of total exports); and exports to India were valued at \$743.2 million (10.6% of total exports) (Central Statistical Organization, 2009, p. 9-10, 18-19).

Commodity Review

Metals

Nickel.—In July 2009, Burma's state-owned Mining Enterprise No. 3 (ME-3) signed a 50-50 joint-venture agreement with China Nonferrous Metal Mining Nickel Co. Ltd. (CNMC) to develop the Tagaung Taung (Dagongshan) nickel mine, which is located in the Thabeikying, Mandalay Division. CNMC agreed to provide all the investment necessary for the project. The mine, which would include an 85,000-metric-ton-per-year (t/yr)-capacity ferronickel plant that could lead to the production of 22,000-t/yr of nickel metal, was projected to be commissioned in 2011 (Metal Bulletin, 2008; New Light of Myanmar, The, 2008).

Industrial Minerals

Gemstones.—In July 2008, the U.S. President signed into law the Tom Lantos Block Burmese JADE (Junta's Anti-Democratic Efforts) Act of 2008 (Pub. L. 110-286), which prohibits the importation of gemstones (such as jadeite and rubies, including jewelry articles) and hardwoods from Burma to the United States. The Act, which was enacted in response to concerns regarding human and political rights in Burma, calls for the adoption of a resolution to create and implement a certification scheme to prevent the trade of such gemstones.

Outlook

For the past several years, the production of most mineral commodities has decreased exponentially in Burma owing mainly to the withdrawal of mining companies from the country. Burma's mineral production in 2009 will likely be further affected by the significant decline in late 2008 of world market prices and world demand for mineral commodities. As a result of the agreement signed by ME-3 and CNMC, Burma's nickel production is expected to increase after 2011 when the Tagaung Taung Mine is commissioned.

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[1] Where necessary, values have been converted from Myanmar kyat (K) to U.S. dollars (US\$) at the rate of K5.38=US\$1.00 for 2008.

TABLE 1
BURMA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
METALS						
Chromium, chromite, gross weight		364	409	-- [r, e]	-- [r, e]	--
Copper:						
Mine output, Cu content		31,756	34,500	19,500	15,100 [r]	6,900
Matte, gross weight[e, 3]		80	80	80	80	80
Metal, refined		31,756	34,500	19,500	15,100 [r]	6,900
Gold, mine output, Au content[e]	kilograms	90	90	100	100	100
Iron and steel:[e, 3]						
Pig iron		1,500	1,500	1,500	1,500	1,500
Direct-reduced iron		40,000	40,000	40,000	40,000	40,000
Steel, crude		25,000	25,000	25,000	25,000	25,000
Lead:						
Mine output, Pb content[e, 4, 5]		2,000	2,000	2,000	2,000	3,600
Metal:						
Refined		289	907	537	165	202
Antimonial lead (93% Pb)[3]		-- [e]	-- [e]	NA	NA	NA
Manganese, mine output, Mn content[e]		50	50	50	50	50
Nickel:[e]						
Mine output, Ni content		10	10	10	10	10
Speiss (matte), gross weight[3]		10	10	10	10	10
Silver, mine output, Ag content[4, 5]	kilograms	1,120	2,302	684	218	--
Tin, mine output, Sn content:[4, 5]						
Of tin concentrate		330	402	566	499	499
Of tin-tungsten concentrate		196	306	357	331	242
Total		526	708	923	830	741
Metal, refined[e]		30	30	30	30	30
Tungsten, mine output, W content:[4, 5]						
Of tungsten concentrate		1	2	4	4	5
Of tin-tungsten concentrate		106	166	193	179	131
Total		107	168	197	183	136
Zinc, mine output, Zn content[4, 5]		196	78	46	10	20
INDUSTRIAL MINERALS						
Barite		2,224	2,058	2,930	6,813	5,679
Cement, hydraulic		518,999	543,072	570,031	608,192	675,788
Clays:[e, 3]						
Bentonite		815 [r]	602 [r]	904 [r]	900 [r]	900
Fire clay and fire clay powder		114 [r]	97 [r]	-- [r]	100	100
Feldspar[e, 3]		10,000	10,000	10,000	10,000	10,000
Gypsum		71,155	67,522	68,651	75,116	82,224
Nitrogen, N content of ammonia[e]		34,800	30,000	30,000	30,000	30,000
Precious and semiprecious stones:						
Jade	kilograms	12,407,576	19,445,758	20,646,832	20,003,409	30,896,440
Diamond[e]	carats	5	5	5	5	5
Rubies	do.	2,919,147	2,710,002	1,685,481	1,394,939	1,868,696
Sapphires	do.	2,241,803	495,192	422,806	608,008	1,129,039
Spinel	do.	1,037,963	2,014,623	908,555	843,680	572,308
Salt[e, 6]	thousand metric tons	35	35	35	35	35
Stone:						
Dolomite		4,184	3,980	4,460	4,674	4,264
Limestone, crushed and broken[e]	thousand metric tons	3,300	3,400	3,500	3,800	4,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, lignite		237,949	229,647	331,445	283,703	249,442
Gas, natural, marketed	million cubic meters	10,277	11,648	12,501	13,315	12,445
Petroleum:						
Crude	thousand 42-gallon barrels	7,160	8,133	7,675	7,625	7,242
Refinery products[7]	do.	5,133	4,638	4,867	4,885	4,661

See footnotes at end of table.

TABLE 1—Continued
BURMA: PRODUCTION OF MINERAL COMMODITIES[1]

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[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. Do. Ditto. NA Not available. -- Zero.

[1] Table includes data available through March 3, 2010.

[2] In addition to the commodities listed, construction aggregates, sand and gravel, and silica sand are produced, but available information is inadequate to make reliable estimates of output.

[3] Data are for fiscal year ending March 31 of the following year.

[4] Reported figure.

[5] Data are for the production by the state-owned mining enterprises under the Ministry of Mines.

[6] Brine salt production, in metric tons, reported by the Government was 2004—58,395; 2005—116,768; 2006—84,208; 2007—71,323, and 2008—54,355.

[7] Includes diesel, distillate fuel oil, gasoline, jet fuel, kerosene, and residual fuel oil.

Sources: International Fertilizer Industry Association, Ammonia Statistics 2004; Ministry of Mines and Central Statistical Organization (Yangon), Statistical Yearbook 2004 and 2007; Selected Monthly Economic Indicators, December 2005, January 2007, May 2008, and January 2009; World Bureau of Metal Statistics, February 2008 and March 2009.

TABLE 2
BURMA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Union of Myanmar Economic Holdings Ltd.	Hsinmin cement plant in Kyaukse, Mandalay Division	146,000
Coal		Mining Enterprise No. 3 (ME-3)	Kalewa coal mine in Sagaing Division, near Kalewa	13,000
Copper		Ivanhoe Myanmar Holdings Ltd. (50%) and Mining Enterprise No. 1 (50%)	Monywa copper project, S&K Mine, and Monywa refinery, in Monywa region, central Burma	40,000
Fertilizer, N content		Myanma Petrochemical Enterprise (Government, 100%)	No. 1 Fertilizer Plant at Sales, 190 kilometers southwest of Mandalay	94,900
Do.		do.	No. 2 Fertilizer Plant at Kyun Chaung, central Burma	75,555
Do.		do.	No. 3 Fertilizer Plant at Kyaw Zwar, central Burma	219,000
Natural gas	million cubic meters	Total E&P Myanmar (31.24%), Unocal Myanmar (28.26%), PTT Exploration and Production Public Company Ltd. (25.5%), Myanma Oil and Gas Enterprise (MOGE) (15%)	Yadana gasfield in Moattama, Gulf of Martaban	7,227
Do.	do.	Petronas Carigali Myanmar Inc. (40.91%), Myanma Oil and Gas Enterprise (MOGE) (20.45%), PTT Exploration and Production Public Company Ltd. (19.32%), Nippon Oil Exploration (Myanmar) Ltd. (19.32%)	Yetagun gasfield in Tanintharyi, Gulf of Martaban	4,635
Do.	do.	Myanmar Petroleum Resources Ltd. and Myanma Oil and Gas Enterprise (MOGE)	Mann oilfield, south of Yangon	37
Petroleum:				
Crude	thousand 42-gallon barrels	do.	do.	876
Refined	do.	Myanma Petrochemical Enterprise (100% state owned)	No. 1 refinery at Thanlyin (near Yangon)	9,490
Do.	do.	do.	No. 2 refinery at Chauk, central Burma	2,190
Do.	do.	do.	No. 3 refinery at Thanbayakan, central Burma	9,125
Steel		POSCO (70%)	POSCO steel plant in Yangon	30,000

Do., do. Ditto.

THE MINERAL INDUSTRY OF CAMBODIA

By Yolanda Fong-Sam

In 2008, Cambodia produced mainly industrial minerals. These included sand and gravel and crushed stone for domestic consumption by the construction industry, and limestone for cement production.

The Ministry of Industry, Mines and Energy (MIME), which implements Cambodia's mineral law and policy, is the Government entity that leads the effort in promoting and developing the industrial sector in the country. The Department of Geology and Mines and the Department of Energy, which are both under the MIME, coordinate the development of the mineral sector. The Council for the Development of Cambodia is the Government agency that grants exploration licenses and mining licenses to investors. The mining licenses are granted upon success in the exploration phase; a master mining project plan is required as a condition for acquiring such a license (Investincambodia.com, 2009).

During 2008, the Department of Mineral Resources of Cambodia (which is also under the MIME) reported an increase in mineral production. Production of sand used as construction material increased to nearly 6.6 million metric tons in 2008 from about 330,000 metric tons (t) in 2007. The cement sector reported production of more than 770,000 t in 2008 compared with approximately 87,000 t in 2007. The increase in cement production was mainly attributable to the commissioning and operations of Cambodia's first major cement plant, which was located in the coastal Province of Kampot. The plant was a $93 million investment between Khaou Chuly Group (a construction firm in Cambodia) and Siam Cement Group of Thailand, through the joint-venture Kampot Cement Co. Kampot Cement expected to double its cement production capacity in 2009 and again in 2010 (table 1; Reuters.com, 2008).

Chevron Overseas Petroleum (Cambodia) Ltd. announced in late 2008 that it was intending to bring Cambodia's first oilfield onstream and begin production in 2009. The oilfield, Block A, was discovered in 2005 and is located 200 kilometers offshore. The main shareholders in this project were Chevron (55%), Mitsui & Co., Ltd. of Japan (30%), and GS Caltex Corp. of the Republic of Korea (15%) (Petroleum Economist, 2008).

Outlook

The mineral industry of Cambodia is likely to continue to be dominated by the production of industrial minerals. Increases in the production of industrial minerals are likely to depend on the performance of the projects that started recently in the country. The mining sector in Cambodia is at an early stage of development.

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TABLE 1

CAMBODIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]	2004	2005	2006	2007	2008
Cement	--	--	--	86,990	772,029
Gravel	--	22,500	45,625	36,250 [r]	37,500 [e]
Laterite, blocks	118,400	--	--	312,718 [r]	454,750
Salt	40,000	--	59,000 [r]	76,651 [r]	78,000 [e]
Sand, construction material	363,700	763,900	2,043,500	329,028 [r]	6,581,500
Stone:					
Crude construction material	501,600	1,079,400	676,832 [r]	1,433,086 [r]	2,039,336
Limestone	--	--	--	1,000,000 [e]	1,000,000 [e]

[e] Estimated; estimated data are rounded to no more than three significant digits. [r] Revised. -- Zero.

[1] Table includes data available through March 4, 2010.

[2] In addtion to the commodities listed, clay, gemstones, gold, and iron ore are presumably produced, but available information is inadequate to make reliable estimates of output.

Source: Cambodia's Ministry of Industry, Mines and Energy, General Department of Mineral Resources; U.S. Geological Survey Minerals Questionnaires for Cambodia 2003-08.

TABLE 2
CAMBODIA: STRUCTURE OF MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity^{e}
Cement		Kampot Cement Co. Ltd. (a joint-venture of Khaou Chuly Group of Cambodia and Siam Cement Group of Thailand)	Touk Meas District, Kampot Province	1,000
Gemstones	carat	Jirech International Cambodia Construction and Import-Export Co. Ltd.	Anlong Krapeu-Preak Bey, Samlot District, Batdambang Province	NA
Do.		Seoul Digem Cambodia Co. Ltd.	Loamphat District, Ratanah Kiri Province	NA
Do.		Sonuba Cahm Industries Co. Ltd.	Phnom Trop, Pailin City	NA
Do.		Ultra Marine Kiri (Cambodia) Ltd.	Pating Thom Village, Ting Chak Commune, Borkeo District, Ratanah Kiri Province	NA
Do.		do.	Sen Chauv, Samlot District, Batdambang Province	NA
Granite		TTY-RITHYMEXICO	Svay Chreas District, Kracheh Province	NA
Limestone		Kampot Cement Co. Ltd.	Tatung, Kampot Province	1,500
Do.		Thai Boon Roon Cement Co. Ltd.	Phnom Laang Laan Commune, Donghtung District, Kampot Province	NA
Do.		United International (Cambodia) Foreign Investment Group Co. Ltd.	East Touk Meas, Banteay Meas District, Kampot Province	NA

^{e}Estimated. Do., do. Ditto. NA Not available.

THE MINERAL INDUSTRY OF CHINA

By Pui-Kwan Tse

During the past three decades, China has made remarkable gains in industrialization and development. The gross domestic product (GDP) has maintained a growth of about 9% per year. The role of private sector market mechanisms expanded steadily, whereas direct Government control over economic activity diminished gradually. In the financial and mineral sectors, where reforms lagged, major large mineral and metal producers and many banks remained either state owned or under the ownership of the Provinces. After many years of development, Chinese enterprises were faced with the challenges of needing to increase their competitiveness through innovation and to create jobs to keep the labor force employed. Chinese exporters remained assemblers and manufacturers of products, without having much knowledge of and without producing innovations in the technology. China had a huge unskilled labor force but a shortage of skilled labor. To sustain its economic development, the Government had been expanding the requirements for all education levels, improving adult literacy, and providing training to rural and urban workers.

China was one of the leading economic and trade powers in the world, one of the top destinations for foreign direct investment, and an export destination of choice. During the past several years, the Government's economic policy was to prevent economic slowdown and fight inflation. In 2008, because of the global economic downturn and natural disasters (severe snowstorms, floods, and an earthquake in Sichuan Province), China's economic growth rate was 9%, which was less than the 13% rate of growth in 2007. Industrial production increased by 9.5% compared with that of 2007. The consumer price index (a measurement of inflation) rose to 5.9% in 2008 compared with 4.8% in 2007. The global financial crisis had only a limited direct effect on China's financial system but it affected the country's export market. China's export volumes in 2008 decreased by 7.3% in November and 7.6% in December compared with the same months in 2007. Imports also decreased by more than 10% during those 2 months. One factor in the decrease in imports was the destocking of raw materials. The official urban unemployment rate increased by 0.2% to 4.2% in 2008; large sections of the working population, however, (including migrant workers) were not eligible to register as unemployed. There were more than 80 million migrant workers (National Bureau of Statistics of China, 2009).

Minerals in the National Economy

China is rich in mineral resources and was the world's leading producer of aluminum, antimony, barite, bismuth, coal, fluorspar, gold, graphite, iron and steel, lead, phosphate rock, rare earths, talc, tin, tungsten, and zinc in 2008. It ranked among the top three countries in the world in the production of many other mineral commodities. China was the leading exporter of antimony, barite, coal, fluorspar, graphite, rare earths, and tungsten in the world. The country's demand for chromium, cobalt, copper, iron ore, manganese, nickel, petroleum, and potash exceeded domestic supply, and imports were estimated to account for more than 30% of domestic consumption. Mineral trade increased by 33.5%, and accounted for 25.7% of the country's total trade in 2008. China was one of the few countries whose domestic supply and demand of a variety of mineral commodities affected the world mineral market. The labor force in the mining sector was 5.35 million, or 4.5% of the country's total workforce in 2007.

Government Policies and Programs

In 2008, owing to the global financial crisis, China's economic growth declined to 6.8% in the fourth quarter from 12.6% in the second quarter. Industrial value-added growth also decreased. Much of the slowdown was the result of weak domestic and international demand. Exports accounted for about 40% of the GDP; of that amount, about one-half was from processing trade; the share of exports in value-added products was less than 20%. Because global growth prospects were distinctly unfavorable for the future, China's export growth was expected to decline during the next 2 years. The weak export outlook would affect investment in export-oriented industries, which was estimated to be about 15% of overall investment in China.

To control inflation and to cool off the economy in 2007, the Government tightened its monetary policies. As a result, the overall real investment growth in 2008, especially in the construction sector, was lower than in 2007. The slowdown in the construction sector contributed to a sharp slowdown in several upstream industries, such as cement, copper, and steel. In November 2008, the State Council announced a fiscal stimulus package worth about 4 trillion yuan ($586 billion) during 2009-10 to promote stable growth in the domestic economy. As part of the package, the Government identified 10 areas where it sought to increase domestic demand and growth, including affordable housing; environmental protection and waste treatment; rural infrastructure investment for drinking water, electricity, and gas; technological innovation for research and development; transportation infrastructure, such as airports, highways, and railways for transporting coal and passengers; and post-disaster reconstruction areas in Sichuan Province. The Government also reformed the value-added tax (VAT) nationwide in 2009 to allow capital spending to be deducted from the VAT, thereby reducing the enterprise tax burden. With the approval of the Government, bank lending increased rapidly during the last quarter of 2008 (Citigroup Global Market Inc., 2008).

Also in the last quarter of 2008, the Government announced that 10 major industries in China—automobile manufacturing, electronic information, equipment manufacturing, iron and steel, light industry, logistics, nonferrous metals, petrochemical, shipbuilding, and textiles—were to be reformed and upgraded. These industries accounted for more than 80% of the country's total industrial output value and about one-third of the

GDP. The Government considered that the reform of these industries could help China compete more effectively with other developed countries. After more than three decades of development, the existing structure of these industries no longer met the requirements of the modern business world. The Chinese enterprises were considered to be weak in independent innovation, had low measures of competitiveness and productivity, depended heavily on external demand, and had undiversified product lines. The reform concentrated on tax relief, expanding credit lines, providing 100 billion yuan ($14.7 billion) in research and development funds during 2009-10, and urging enterprises to merge (China Economic News, 2009c).

During the past two decades, the Government approved, in principle, the Provisional Rules on the Value-Added Tax, the Provisional Rules on the Consumption Tax, and the Provisional Rules on the Business Tax. The production-based VAT was introduced in 1994 to increase the Government's tax revenue and curb excess investment; this tax, which accounts for 31% of the country's tax revenue, caused much confusion for producers and exporters, however. During the past several years, the Ministry of Finance (MOF) and the State Administration of Taxation had urged the Government to reform the production-based VAT. In 2003, the Government started a trial operation to convert the production-based VAT to a consumption-based VAT for eight industries, which included equipment manufacturing and petrochemical production in several Provinces. The Government's plan was to convert to the consumption-based VAT throughout the whole country by the end of 2010. The reformed VAT would reduce the enterprise tax burdens on the equipment manufacturing industry. The Government would abolish the exemption for the VAT on imported equipment and the VAT refund for purchases of domestically manufactured equipment by foreign investors. Both domestic and foreign investors would be taxed at the same rate. The resource tax rate on mined mineral products would increase to 17% from 13%, including imports, except for salt, the tax on which would remain at 13% (China Economic News, 2008; Ministry of Finance, 2008b).

The State-owned Assets Supervision and Administration Commission planned to merge smaller and underperforming state-owned enterprises with other state-owned enterprises. The Commission's plan was to reduce state-owned enterprises to between 30 and 50 from 100 by yearend 2010. The Commission also banned state-owned enterprise employees, particularly management staff, from holding shares in their affiliates and subsidiaries but allowed them to hold shares of their own companies. They were also not allowed to invest in companies that had a business connection with their enterprises. These regulations did not apply to listed companies that were held mainly by the state. The Government would strictly control the participation of state-owned enterprises in investment or acquisition of foreign companies during the global financial crisis. The MOF and other agencies jointly issued the basic standards for enterprise internal control guidelines that would be implemented on July 1, 2009 (China Economic News, 2009b; Citigroup Global Market Inc., 2009).

In 2008, the Ministry of Land and Resources (MLR) issued the national plan on mineral resources (2008-15). The plan established annual production targets for coal [3.3 billion metric tons (Gt)]; iron ore (1.1 Gt); oil [200 million metric tons (Mt)]; tin [150,000 metric tons (t)]; antimony (140,000 t); rare earths (rare-earth oxide content) (140,000 t); and tungsten (78,000 t) in 2015. The Government projected that coal consumption would total 3.5 Gt; iron ore, 1.5 Gt; oil, 500 Mt; aluminum, 14 Mt; and copper, 7.6 Mt in 2020. The country was expected to face a shortage of 19 mineral commodities among the 45 major mineral commodities produced. The dependence on imports of copper and potash was expected to be 70%; oil, 60%; and iron ore, 40%. During the past several decades of exploration, geologists believed that about one-third of total mineral resources had been discovered in China. Most of the undiscovered mineral resources were expected to be located in the western part of the country.

The Government planned to establish special funds for the exploration of bauxite, chromite, copper, iron ore, lead, manganese, nickel, potash, and zinc. Exploitation of antimony, barite, fluorspar, graphite, magnesite, phosphate rock, rare earths, talc, tin, and tungsten would be strictly monitored, and exports of these commodities would be placed in a quota system. Production of bauxite and molybdenum would also be based on the Government's plan. The Government would monitor the production of germanium, indium, niobium, vanadium, and other rare metals. The Government would establish a strategic mineral reserve system on such commodities as chromium, coal, copper, germanium, indium, manganese, oil, rare earths, and tungsten. The Government would not issue any mining license to companies that used obsolete mining methods and would encourage companies to modernize their mining technologies to minimize the harm to the country's ecological system. The MLR also issued regulations on the management of the geologic survey system in 2008 (Ministry of Land and Resources, 2008a, b).

Owing to the global financial crisis, the demand for nonferrous metals had decreased and prices of nonferrous metals declined significantly during the second half of 2008. During the past several years, China's nonferrous metal output capacity had increased rapidly, and, globally, the nonferrous metals supply exceeded demand in 2008. Even though nonferrous metal producers shut down their operations temporarily, the prices of nonferrous metals continued to decrease, and China's nonferrous metal producers requested help from the Government. The State Council ordered the State Reserve Bureau (SRB) to stockpile 1 Mt of aluminum, 400,000 t of copper, 400,000 t of lead and zinc, and 30 t of indium from domestic producers to stabilize metal prices in the domestic market. The Government also urged Provincial and local governments to do the same for other metals. Metal producers urged the Government to stockpile such other commodities as antimony, nickel, tin, and tungsten that were in short supply or important to the country's economy. The Provincial government of Yunnan announced that it would stockpile a total of 1 Mt of aluminum, copper, lead, tin, and zinc. A local government in Jiangxi Province planned to stockpile rare earths and tungsten (China Metal Bulletin, 2009f; Recycling Resources, 2009).

The Ministry of Commerce (MOC) and the MLR jointly issued regulations on the administration measures on foreign investment in mineral prospecting. The Government encourages foreign investors to participate in mineral prospecting and exploration in China. Under the guidelines for foreign investment, if foreign investors are involved in prospecting for a mineral commodity that is in the restricted category, the MOC is the sole approval and management agency. For other categories, the Provincial or local government has the power to approve prospecting by a foreign investor with the concurrence of the MLR local office. Foreign prospectors are required to submit an annual report that details the progress of their prospecting, their tax payment, their environmental protection work, and their land usage to the approval agency before March of each year. If the foreign prospector discovers a commodity that is in the forbidden category, the prospector must transfer the prospecting license to a lawful prospector (Ministry of Commerce, 2008a).

The Government planned to establish a national coal exchange that would provide coal market information to both buyers and producers. Owing to insufficient market information, producers from the northern China were shipping their coal to southern China without having reliable infrastructure information. Each year, millions of tons of coal was stored on the docks of coastal ports waiting to be shipped. Coal-fired powerplants in southern China were turning to overseas coal suppliers for their needs. The National Development and Reform Commission (NDRC) was looking for an appropriate location for the proposed national coal exchange. Shanxi Province and the Nei Mongol Autonomous Region were the two major coal producers in China and there was surplus coal production in these two Provinces. NDRC planned to have a trial run for the exchange in 2010 and to launch a coal futures market in 2012 (China Energy Weekly, 2009a).

The State Electricity Regulatory Commission planned to allow more power consumers to bypass the grid companies and to purchase electricity directly from power producers. In 2005, the Government allowed large power consumers in northeastern Jilin Province and Taishan in Guangdong Province to purchase electricity from power producers. Other consumers must purchase electricity from grid companies. Direct trade between consumers and power companies would affect the grid companies' monopoly. In 2007, the Government had discontinued the practice of giving preferential power rates to energy-intensive users, such as those that produce aluminum, ammonia, caustic soda, cement, copper, ferroalloys, yellow phosphorus, and zinc. In July 2008, the NDRC increased the price of electricity by 25 yuan per million-watthour. Owing to the global financial crisis and the decrease in the demand for electricity, some local governments went against the policy of the central Government and reinstituted the preferential power rates for energy intensive-users as a way to stimulate the local economy. The Government planned to allow about 15 large aluminum producers to bypass the grid companies and to purchase electricity from power companies directly. The price of the electricity would be negotiated between the aluminum producers and the power companies (China Metals, 2008b; China Energy Weekly, 2009b).

The MOC planned to release investment regulations for Chinese companies in foreign countries. According to the proposed regulations, any Chinese company investment of more than $100 million in a country that does not have diplomatic relations with China or that is politically unstable is subject to Government approval. A Provincial government can approve investment of more than $10 million in foreign countries. With energy and mineral projects, the MOC will consult with China's embassy in the foreign country and with related associations before issuing its approval (Metallurgical News, 2009).

The Chinese Government had become more concerned about the continual inflow of foreign exchange into China because of the potential effect on the stability of China's economy. The State Administration of Foreign Exchange Circular nos. 29, 30, and 31 introduced a new mechanism for tracking the inflow of foreign exchange through trade accounts into China. Exporters are required to open special bank accounts for the collection of export proceeds in foreign exchange and to perform foreign debt registration for any advance collection of export proceeds in foreign exchange before actually exporting the goods. Importers are required to perform similar foreign debt registration. The regulation does not allow a company to convert export proceeds collected in advance into Chinese currency to finance its operation until the actual export has taken place (PricewaterhouseCoopers, 2008).

China's mineral resources law was enacted in 1986 and amended in 1996. The Government believed that the changes were necessary to attract foreign investment in mineral development and production in China. In 2003, the MLR established a mineral-resources-law consultation committee to seek recommendations from domestic and overseas mining experts. After several years of discussion, the resource tax item remained an issue of some disagreement among individual agencies within the Government. The MLR planned to complete a draft of the amended regulation by 2009. A new energy law was also at the final stage of consultation before being submitted to the National People's Congress for approval (Metallurgical News, 2008).

Production

China was one of the world's leading countries in the production of aluminum, antimony, barite, bismuth, cement, coal, copper, fluorspar, gold, graphite, indium, iron and steel, lead, lime, magnesium, manganese, molybdenum, phosphate rock, rare earths, salt, silver, talc, tin, tungsten, and zinc. The output quantity of these mineral commodities could have significant effects on world markets. In 2008, production of such commodities as aluminum, antimony, bismuth, coal, copper, gold, iron and steel, lead, manganese, molybdenum, nickel, phosphate rock, soda ash, tin, titanium, and zinc increased compared with that of 2007 (table 1). China's reform priorities were to improve the efficiency of resource allocation and to boost economic growth. The Government understood that the unbalanced growth of consumption, investment, and net exports could not continue unabated forever. During the past several years, the Government reduced export tax rebates on ferrous and nonferrous metal products, increased export duties on energy-intensive metals, and encouraged producers to produce high-value-added products. Owing to increasing domestic and overseas demand, the growth of China's minerals and metals output was expected to continue.

The MLR announced that the production quota in 2009 for antimony (metal content), rare earths (rare-earth oxide content), and tungsten (tungsten trioxide content) were 90,180 t, 82,320 t, and 68,555 t, respectively. In 2008, the production targets for rare earths and tungsten were 87,620 t and 66,850 t, respectively, and there was no production quota for antimony. A set of production quotas was assigned to each Province. The Ministry of Industry and Information Technology (MIIT) set the national production quota for rare earths at 110,700 t in 2009, which was higher than that set by the MLR. During the past several years, the actual outputs of rare earths were higher than the MLR quota. The MIIT rare-earth quota appeared to be more reflective of the actual output of the country. In 2008, local governments were in charge of allocating quotas to rare-earth producers. The MIIT was established in 2008 during the restructuring of the State Council and it appeared that there was a lack of communication between the MIIT and the MLR about which agency should assign the national rare-earth production quota. For antimony, Hunan Province was allocated 36,000 t followed by Guangxi Zhuangzu Autonomous Region, 17,000 t; Yunnan Province, 4,000 t; Gansu Province, 2,100 t; Henan Province, 1,500 t; Guizhou Province, 1,300 t; and nine other Provinces, less than 1,000 t each in 2009. The Government held off assigning the remaining 25,000 t of the national antimony quota until further notice. For rare earths, Nei Mongol Autonomous Region accounted for more than 50% of the total allocation followed by Sichuan Province, Jiangxi Province, and Guangdong Province. Jiangxi Province would be the leading tungsten production base followed by Hunan Province, Yunnan Province, Henan Province, and Guangdong Province. The MLR announced that it would not accept any new antimony, rare-earths, or tungsten exploration and mining permit applications until June 30, 2010 (Ministry of Land and Resources, 2009).

China's State Council approved a 3-year plan to stimulate the nonferrous metal industry, which would focus on industrial restructuring and technology innovation. The Government planned to eliminate obsolete smelting capacity, which would include 600,000 metric tons per year (t/yr) of lead, 400,000 t/yr of zinc, and 300,000 t/yr of copper at yearend 2009 and 800,000 t/yr of small-scale prebaked cells (prebaked cells of less than 160 kiloamperes) for production of aluminum by yearend 2010. Direct-current power consumption for each ton of aluminum produced would be reduced to 12,500 kilowatts per hour. The total energy consumption of lead smelting would be reduced by 380 kilograms (kg) of standard coal equivalent per ton of lead. The rate of recovery of sulfur from nonferrous metal production would increase to 97%, which would reduce emissions of sulfur dioxide by 850,000 t/yr. The Government urged the industry to consolidate through merger of nonferrous metal producers. The goal was for the top 10 copper producers to produce about 90% of the total copper production by 2011 and the top 10 aluminum, lead, and zinc producers to produce 70%, 60%, and 60%, respectively, of the country's total production. The Government would not approve new construction or expansion of aluminum smelters during the next 3 years and would control strictly any project for new or expanded capacity for copper, lead, magnesium, titanium, and zinc producers. The Government encouraged the production of more value-added nonferrous metal products. Secondary aluminum and copper outputs were expected to account for 25% and 35%, respectively, of total production. The Government also encouraged cross-sector mergers, such as of aluminum and coal producers or aluminum and power producers (Ministry of Industry and Information Technology, 2009b).

In 2008, the total fixed-asset investment of the nonferrous metals industry was 233.2 billion yuan ($35 billion), which was a 40% increase from that of the previous year. Of this amount, newly started fixed-asset investment accounted for 88% of the total, and only $641 million was foreign direct investment. Of the total nonferrous metals investment, mining development accounted for 22.2%; smelting, 47.5%; and processing, 30.3%. The aluminum sector accounted for 38% of the total smelting investment followed by copper, 14%; lead and zinc, 12%; and others, 36%. Owing to the global financial crisis and the Government's macro-control policy, the growth of fixed-asset investment in the nonferrous metals industry was expected to slow down during the next 2 years (China Metals, 2009c).

Structure of the Mineral Industry

China's mining industry is highly fragmented and had a poor safety record. Several companies often mined in a single mining area. As a result, miners searched for resources and ignored laws and regulations regarding safety and the environment. The State Council approved a mining consolidation plan that had been proposed jointly by the MLR, the NDRC, and other agencies. Fifteen mineral commodities—antimony, bauxite, coal, copper, gold, iron ore, lead, manganese, molybdenum, phosphorus, potassium, rare earths, tin, tungsten, and zinc—were on the consolidation plan. The Central Government worked with local governments to implement the plan. Small mine operators were targeted to be integrated into large operators through such means as acquisition or joint-management agreements. The State Assets Administration would transfer state-owned assets of these small operators to the large operators. The Government would not allow any expansion of mining boundaries during the consolidation period, which was scheduled to be completed by yearend 2008. The Government would not issue mining operation permits to uncooperative mine operators. Local governments were required to submit their consolidation plans to the MLR for recording (China Economic News, 2009c).

According to the Government's stimulus plan, company consolidation was one of the priorities. The governments of the Provinces of Guangdong, Guangxi, Hebei, Shandong, and Shanxi decided to merge their iron and steel producers into larger enterprises. The Government extended its suspension of the issuance of new coal exploration permits until March 31, 2011 (China Mining and Metals Weekly, 2009b).

Mineral Trade

According to the customs statistics, China's total trade was valued at $2.56 trillion in 2008; this was an increase of 17.8% compared with that of 2007. Exports posted an increase of 17.2% to $1.43 trillion, and imports were up by

8.2% to $1.13 billion. The United States remained the leading destination for China's exports followed by the European Union (EU), Hong Kong, and Japan. Japan was China's leading source of imports followed by the Republic of Korea and the EU. Imports of raw materials, such as bauxite, chromium ore, iron ore, manganese ore, potassium fertilizer, and oil, increased sharply. In 2008, the value of mined mineral product imports increased to $231.1 billion, which was an increase of 59.2% from that of 2007. The value of mined mineral product exports increased to $14.7 billion, which was an increase of 43.8% (General Administration of Customs of the People's Republic of China, 2008).

The MOC issued Circular no. 22, which included a list of mineral commodities that were banned for processing trade in 2008. Mineral commodities that were on the Government's monitoring list for export were ammonium paratungstate; bauxite and refractory clay; coal; coke; concentrates of antimony, cobalt, gold, silver, tin, tungsten, and zinc; dolomite; fluorspar; magnesite; oxides of antimony, magnesium, and tungsten; platinum; rare earths; silicon carbide; silver; talc; and unwrought metal and alloys of antimony, copper, nickel, tin, and zinc. The MOC issued Circular no. 121 that removed cobalt concentrates from the Government's list of banned exports and several companies received exemptions for allowing import processing trade on concentrates of copper and nickel in 2009. Cobalt sulfide, palladium chloride, and other precious compounds were removed from the banned export processing list (Ministry of Commerce, 2008e).

All antimony products would be required to be registered and exported through the Port of Beihai in Guangxi Zhuangzu Autonomous Region, the Port of Huangpo in Guangdong Province, and the Port of Tianjin City. The Port of Dalian in Liaoning Province was designated as the port of issuance of export licenses for magnesia, which could be exported through the Port of Changchun in Jilin Province, the Ports of Dalian and Manshouli in Heilongjiang Province, and the Port of Qingdao in Shandong Province. The Government adjusted the 2009 export quotas for phosphate rock to 1.5 Mt; magnesia, to 1.4 Mt; bauxite, to 950,000 t; talc, to 610,000 t; fluorspar, to 550,000 t; silicon carbide, to 216,000 t; antimony and antimony products (metal content), to 58,700 t; molybdenum, to 25,500 t; tin and tin products (metal content), to 23,300 t; tungsten and tungsten products (metal content), to 14,600 t; silver, to 5,100 t; and indium, to 233 t. The first batch of export quotas for mineral products usually accounted for 60% of the total export quota. The MOC also issued guidelines for enterprises that had the right to supply and export antimony, coke, ferroalloys, indium, molybdenum, rare earths, silver, and tungsten. The import quota for ammonium phosphoric acid was set at 6.90 Mt; complex fertilizer, 3.45 Mt; and urea, 3.30 Mt. Imports of mined mineral products would be subject to a 17% mineral tax, as were domestic mined mineral products. On August 20, 2008, the export tariff rate for aluminum products was levied at 15%; the rate for coke was increased to 40% from 25%; and the rate for coking coal and bituminous coal was increased to 10% from 5%. The Government intended to discourage traders from exporting coal products, which would help ensure sufficient supply and stabilize prices in the domestic market during the harvest period. The MOF planned to reduce the export tariff rate for oxides of aluminum, molybdenum, and tungsten, molybdenum and tungsten chemical products, molybdenum and indium powders, and unwrought indium and molybdenum to 5% from a range of 10% to 15% beginning on July 1, 2009 (Ministry of Commerce, 2008b, c, f; Ministry of Finance, 2008a; 2009).

Owing to an increase in domestic demand and to conserve domestic mineral resources, the Government reduced export quotas on key commodities. Although the export quotas for coal, coking coal, and rare earths were not publicly available, the announcement of the changes in the export allocations and an increase in tariffs for those commodities indicate that the export volume of the commodities would likely decrease in 2009 compared with that of 2008. The total export quota for coke was 12.01 Mt; of that amount, the first batch was 9.62 Mt and the second batch was 2.39 Mt in 2008. In 2009, the first batch export quota for coke was 5.78 Mt. The total export quota for rare earths (rare-earth oxide) was 34,156 t (22,780 t for the first batch and 11,376 t for the second batch) for domestic rare-earth producers and 8,210.5 t for Sino-foreign joint-venture producers in 2008. In 2009, the first batch export quota for rare earths was 15,043 t for domestic rare-earth producers. The Sino-foreign joint venture rare-earth producers were assigned a total of 6,685.1 t (Ministry of Commerce, 2008g-j).

Commodity Review

Metals

Aluminum.—Owing to a winter storm, the power supply system in the Provinces of Guizhou, Guangxi, Hunan, and Sichuan was damaged and forced aluminum smelters in these Provinces to shut down their operations in February. The earthquake in Sichuan Province destroyed several aluminum smelters in the earthquake area in May. The global financial crisis reduced the demand for aluminum in China and the world; nevertheless, China's aluminum metal production continued to increase in 2008. To support the aluminum sector, China had imported large quantities of alumina to meet the demand. In 2003, the country imported 5.6 Mt of alumina, which accounted for about 50% of total demand. By 2008, the volume of imported alumina was 4.6 Mt, mainly from Australia and India, but the imported alumina met only about 17% of the country's demand. During the past several years, about 23 alumina projects were either completed or under construction and more than 10 alumina projects were in the feasibility stage. By yearend 2008, China's alumina output capacity could reach 36 million metric tons per year (Mt/yr) (Alumina and Aluminum Monthly, 2009).

Owing to the rapid expansion of alumina output capacity and the weak demand for alumina, the price per metric ton of alumina decreased five times to about 2,000 yuan ($294) at yearend from 4,200 yuan ($615) at the beginning of 2008. The price per metric ton of aluminum also decreased from the peak of 19,727 yuan ($2,900) in March to 12,045 yuan ($1,770) in December. Owing to a surplus of alumina in the domestic market, Aluminum Corporation of China (Chinalco) shut down about 1 Mt of alumina output capacity during the second half of the year. Owing to the surplus of aluminum on the domestic market, 20 major aluminum producers agreed to reduce output by 5% to 10% in July. At yearend, about 4.4 Mt of aluminum output capacity was idled, which did not include about 2 Mt of output capacity that had not been put into operation. To prevent further decline in the price of aluminum on the domestic market, the SRB purchased a total of 590,000 t of aluminum from domestic aluminum producers at a price of between 12,490 yuan ($1,836) and 12,350 yuan ($1,816) per metric ton; about 50% of the aluminum was purchased from Chinalco (China Metals, 2009e).

The rapid expansion of alumina output capacity could create fierce competition for bauxite resources. The Provinces of Guangxi, Guizhou, Henan, Shandong, and Shanxi accounted for about 90% of the country's bauxite resources. After years of exploitation, bauxite resources in Shandong Province were nearly depleted. Aluminum refineries in Shandong Province relied on imported bauxite to meet their demand. In 2008, China imported 25.79 Mt of bauxite compared with 23.26 Mt in 2007, mainly from, in descending order of amount imported, Indonesia, Australia, and India. During the past several years, China discovered several new bauxite deposits, including the Chongzuoshi and the Fusui deposits (both in Guangxi Zhuangzu Autonomous Region); the Cazhuyuan and the Heitutian deposits at Qingzhen, the Luobuchong deposit at Zhijin, the Tianmashan deposit at Xiuwan, and the Wachangping deposit at Wuchuan (all in Guizhou Province); the Fudian-Minchi deposit in Henan Province; the Baode and the Jinggou deposits at Yangqu, and the Pangjianzhuang deposit at Jiaokou (all in Shanxi Province); and the Sanjiang deposit at Dianxi in Yunnan Province. China had bauxite resources of 2.0 Gt in 2006 (China Nonferrous Metals, 2008, 2009a).

In 2008, the NDRC approved the following two alumina projects: Aluminum Corp. of China. Co. Ltd. (Chalco) subsidiary Zhongzhou Aluminum Plant's 700,000-t/yr expansion plan and Yunnan Aluminum Co. Ltd.'s 800,000-t/yr project in Wenshan, Yunnan Province. The Wenshan alumina project was a joint investment of Wenshan Chengxiang Development and Investment Co., Yunnan Aluminum Co. Ltd., Yunnan Dounan Manganese Co. Ltd., and Yunnan Metallurgical Group. The Wenshan alumina project included the construction of a 1.78-Mt/yr bauxite mine and a coal-fired powerplant. The mine had bauxite reserves of 110 Mt, and Yunnan Aluminum continued to explore bauxite resources in the Wenshan area. Yunnan had a 500,000-t/yr aluminum smelter and a 160,000-t/yr aluminum semimanufacturing plant in Yunnan. After completion of the alumina project in 3 years, Yunnan Aluminum would become an integrated aluminum producer (Alumina and Aluminum Monthly, 2008).

After more than 2 years of construction, Yangquan commissioned its 1.2-Mt/yr aluminum refinery in December 2007. The Shanxi Provincial government allocated all local bauxite resources, except two mines, to support the project. About 90 Mt of bauxite reserves was discovered in the eastern part of Shanxi Province. Hangzhou Jinjiang Group started the construction of a 200,000-t/yr chemical-grade alumina refinery at Tiandong, Guangxi Zhuangzu Autonomous Region, in December 2008. Hangzhou Jinjiang's subsidiary Coalmine Aluminum (Sanmenxia) Co. Ltd. commissioned its 500,000-t/yr aluminum refinery at Xiaoyi, Shanxi Province, which was the first phase of Hangzhou Jinjiang's 2-Mt/yr alumina project (China Metals, 2009f).

Other alumina expansion projects included Shanxi Yangquan Coal Industry (Group) Co. Ltd. at its existing facility at Yangquan; Luoyang Xiangjiang Wanji Aluminum Co. Ltd. at Luoyang, Henan Province; Chalco's Pingguo Aluminum Co. in Guangxi Province; the Zhengzhou Aluminum Plant in Henan Province; and the Luneng Jinbei Aluminum Co. Ltd. in Shanxi Province. Refineries were being constructed by such companies as (in order of location) Chalco Nanchuan Aluminum Co. in Chongqing City; Chalco Zunyi Aluminum Co. and Galuminium (Guizhou) Co. Ltd. in Guizhou Province; Guixi Huayin Aluminum Co. Ltd. in Guangxi Province; Henan Zhongmei Aluminum Co. Ltd., Huiyuan Chemical Engineering Co. Ltd., and Xinyuangfeng Industry Co. in Henan Province; Shanxi Wusheng Aluminum Co. Ltd. in Shanxi Province; and Yunnan Aluminum Co. Ltd.'s Wenshan plant in Yunnan Province. By 2010, China's alumina output was expected to have increased sufficiently to meet domestic demand (China Metals, 2008c).

Datang Group's subsidiary Datang International Power Generation Co. completed the construction of 3,000-t/yr alumina pilot plant at Ordos (Erduosi), Nei Mongol Autonomous Region. Datang had developed an extraction technology to extract alumina from fly ash produced from the Datang Tuoketuo coal-fired powerplant, which contained nearly 50% alumina. The company also demonstrated that the purity of alumina met the industrial specifications. The alumina can be used for the production of aluminum-silicon-titanium alloy. The company planned to build a 200,000-t/yr alumina extraction plant and a 140,000-t/yr alloy plant. In 2006, Erduosi Aluminum Co. conducted a similar extraction process, and a 400,000-t/yr alumina plant was under construction and was expected to be completed in 2009 (China Nonferrous Metals, 2009c).

Despite the Government's macro-control policy, the country's aluminum output continued to increase by about 5% compared with that of 2007, although the growth rate was the lowest since 2000. To further control the expansion of aluminum output capacity, the Government eliminated all preferential power prices. Owing to the increased aluminum export duty rate, the export volume of aluminum metal decreased to 160,793 t in 2007 and 110,127 t in 2008; however, China's aluminum imports were 111,363 t in 2007 and 121,641 t in 2008. China's aluminum imports were mainly from, in descending order of amount imported, Russia, Australia, and India. China became a net importer of aluminum in 2008. Apparent aluminum consumption in 2008 was about 13.2 Mt. During the past 2 years, the decrease in aluminum exports was in part the result of the Government levying an export tariff on primary aluminum. No export tariffs were levied on aluminum alloys or high-end semimanufactured products in the first half of 2008, however. During the first 7 months of 2008, the volume of alloy exports increased by 140% compared with the same period in 2007. On August 20, 2008, the Government levied a 15% export duty on alloys. As a result, the export of these products decreased significantly during the second half of 2008. China's aluminum metal output capacity was estimated to be about 19 Mt/yr in 2008. Several aluminum expansion projects were expected to be completed in 2008, including at the Baotou Aluminum Plant, the East China Aluminum Plant, the Henan Xichuan Aluminum Plant, the Huomei Hongjun Aluminum Plant, the Kaili Yangguang Aluminum Plant, the Qingtongxia Aluminum Plant, the Renping Xinga Aluminum Plant, the Tianyuan Aluminum Plant, the Weiming Aluminum Plant, and the Weiqiao Aluminum and Power Plant (China Metals, 2008a).

During the past 2 years, Chinalco was active in the international mineral market. In 2007, Chinalco took over Peru Copper Inc. of Canada for $2 billion and, in 2008, Chinalco joined with Alcoa Inc. of the United States to purchase a 12% share of Rio Tinto plc for $14 billion. Chinalco planned to invest $19.5 billion to acquire a share of Rio Tinto's properties, which included a bauxite mine, an aluminum refinery and smelter, an iron ore mine, and a power station in Australia and a copper mine in Chile. The transaction required the approval of Rio Tinto's shareholders and the Australian Government (Metal Bulletin, 2009).

Antimony.—China was the leading antimony producing country in the world. Changes in the volume of China's production and exports could affect prices of antimony in the world market. China's antimony resources are located in the Provinces of Guangdong, Guangxi, Hunan, Sichuan, and Yunnan. Guangxi, Hunan, and Yunnan were the top antimony producing Provinces in China and accounted for 90% of the country's total antimony metal output in 2008. Owing to the expansion of smelting capacity during the past several years and to the Government's shutting down of many illegal mining activities in the Provinces of Guangxi, Hunan, and Yunnan, the supply of domestic antimony concentrates was insufficient to meet the smelters' demand; therefore, the country imported a large quantity of antimony concentrates mainly from Kazakhstan and Turkmenistan. China imported 19,264 t of antimony concentrates and 1,553 t of antimony oxide in 2008. China exported 52,389 t of antimony oxide and 9,453 t of unwrought antimony, mainly to Japan, the Republic of Korea, and the United States. About one-third of antimony products was unaccounted for; therefore, the exported volume of antimony products was likely to be higher than the reported customs statistics (China Metal Bulletin, 2009a).

The Chinese Government considered antimony to be one of the protected and strategic minerals, and exploitation and production of antimony was controlled strictly. Even with the Government's macro-control policy, however, antimony metal output continued to increase in recent years. The Government added antimony to the production quota list and restricted the exploration for antimony. In 2007, the Government cancelled the export VAT rebate and levied a 5% export tariff on antimony ingot. As a result, a large volume of antimony products was exported through Vietnam to other countries illegally. Owing to a snow storm in the Hunan Province and contamination of water resources by an antimony smelter in Lemshuijiang, antimony production was disrupted during the first half of 2008. During the same period, the Government enforced the patrol at the border between China and Vietnam and at the Guangzhou Port in Guangdong Province. The price of antimony increased to about $6,000 per metric ton in Europe. Because of the high price of antimony ingot on the international market, antimony producers increased their output. China's antimony consumption was estimated to be about 70,000 t in 2008. Owing to the production quota set by the Government and the declining demand for antimony in East Asia and the United States, China's antimony output was expected to decrease to less than 100,000 t, and the price of antimony was expected to decline in 2009 (China Metal Bulletin, 2009e).

Cobalt.—China was one of the leading mobile phone producers in the world. The demand for cobalt batteries has driven the rapid expansion of cobalt-refining facilities in China. The country had limited cobalt resources and required a large quantity of cobalt to support the development of the cobalt battery sector. In 2008, China imported 254,511 t of cobalt concentrates compared with 118,144 t in 2007. The cobalt content in imported concentrates was about 6%, which was equal to about 15,000 t of cobalt. The volume of unwrought cobalt and powder exports and imports were 2,886 t and 8,829 t, respectively, in 2008. The net import of cobalt was about 21,000 t. The country produced a total of about 4,000 t of cobalt (1,200 t from mine output and 2,800 t from secondary recovery). Domestic analysts estimated that the consumption of cobalt was about 12,600 t and that stockpiled cobalt totaled about 4,500 t in 2008. The increase in the volume of cobalt concentrate imports, mainly from the Democratic Republic of the Congo, was caused by the lower metal content in concentrates. The use of cobalt in batteries accounted for 50% of the total consumption, followed by cement carbide, 13%; glazing, 10%; chemical catalysts, 8%; magnets, 5%; and others, 14% (China Metal Bulletin, 2009b).

Copper.—Owing to domestic smelter and refinery expansions, China's copper output increased sharply during the past several years. Many domestic analysts believed that the rate of China's copper production would be slower than in previous years because of the constrained supply of copper concentrates on the world market and because Chinese copper smelters accepted a treatment charge/refining charge (TC/RC) of $47.2 per metric ton/4.72 cents per pound in 2008, which was about 35% lower than the charges in 2007. China's copper producers had difficulty making a profit with such a low TC/RC because of increased production costs. Nonetheless, China's leading copper producers planned to continue their output capacity expansions during the next several years. China's copper smelting and refining output capacity reached 3.1 Mt/yr and 4.6 Mt/yr, respectively, in 2008, and the capacities were expected to increase to 4.0 Mt/yr and 5.0 Mt/yr, respectively, in 2010. Thus, the output of domestic mined copper was expected to increase to about 1 Mt/yr in 2010. The China Smelting Purchasing Team, which was made up of nine major copper producers in China, agreed to the 2009 copper concentrate contract with BHP Billiton Ltd. on a TC/RC of $75 per metric ton/7.5 cents per pound, which was about 58% higher than the charges in 2008 but was lower than $200 per metric ton/20 cents per pound in 2005. The TC/RC was expected to remain low during the next 2 years. With low TC/RC fees, most of China's copper producers faced financial difficulties and relied on treatment of such byproducts as gold, silver, and sulfuric acid to increase revenue (China Metals, 2009d).

With the expansion of refining capacity in China and the high price of copper on the international market during the first half of 2008, the volume of copper imports was expected to decrease for the year. China imported 1.46 Mt of refined copper, mainly from Chile, Japan, and Kazakhstan, which was 2.4% less than in 2007. About 500,000 t of refined copper capacity was added in 2008, and production of refined copper increased to about 335,000 t in November and 301,000 t in December from 267,000 t in January. When the price of copper decreased sharply during the second half of 2008, many copper producers shut down their operations for maintenance, which also contributed to the decrease in the volume of copper imports. Given the high price, however, many domestic traders took advantage of price differences between the London Metal Exchange and the Shanghai Metal Exchange and imported a large quantity of copper in the latter part of the year. The SRB may have purchased as much as 700,000 t of copper from overseas during the second half of 2008 (China Mining and Metals Weekly, 2009a).

During the past several years, copper consumption in China increased by an average of more than 10% per year. The increase in copper consumption was caused by increased demand from the construction, electrical appliance, and power sectors. The power sector accounted for about 50% of the total copper consumption, and the demand was expected to continue to increase in the next several years as the electricity supply network throughout the country is expanded. In 2008, refined copper apparent consumption was estimated to be 4.81 Mt. The actual copper consumption in 2008 might have been lower. In 2008, local governments stockpiled a large volume of copper to support local producers. The stockpile polices of the SRB and the local governments were quite different. The SRB purchased metals and transferred them to its warehouses; local governments provided funds to producers for metals and minerals but the metals and minerals remained in the producers' warehouses (China Metals, 2009b).

Continental Minerals Corp. of Canada completed its feasibility study to develop the Xietongmen copper-gold project, which is located near the city of Rikaze (Xigaze or Shigatse), 240 kilometers (km) west of Lhasa, Xizang Autonomous Region. According to the feasibility study, the Xietongmen deposit contained proven and probable reserves of 182.1 Mt of ore at an average grade of 0.453% copper, 4.03 grams per metric ton (g/t) silver, and 0.62 g/t gold at a 0.15% copper cutoff. The feasibility study recommended a 40,000-metric-ton-per-day copper concentrator to process ore mined by the open pit method. Copper would be recovered by flotation to produce 530,000 t/yr of copper concentrates containing 25% copper, 5.9 t (190,000 troy ounces) of gold, and 53.8 t (1.73 million troy ounces) of silver. The capital cost was estimated to be $476.2 million and the life of the mine was 14 years. Power for this project would be provided by the regional powerplant. A 250-km railway between Lhasa and Rikaze would be constructed. Concentrates would be trucked to either Lhasa or Rikaze and then shipped by railway to Jinchuan Nonferrous Metals Corp. in Jinchang, Gansu Province. Continental and Jinchuan signed an agreement for capital and equity financing, concentrate offtake, and necessary mine building support for the Xietongmen project. The Government approved the conservation plan, environmental impact assessment, and reclamation report. The Industrial and Commercial Bank of China and the Standard Bank Group Ltd. would be the underwriters and mandated lead arrangers for the project's finance debt. Continental planned to apply for the mining license to develop the mine. The Government planned to invest about $544 billion to upgrade the infrastructure of the area (Continental Minerals Corp., 2009).

The first-phase construction of the Yulong copper open pit mine at Dajiang County, Changdu (Qamdo) Prefecture, Xizang Autonomous Region, was partially completed in 2008. The Yulong deposit had proven reserves of 6.5 Mt of copper and 150,000 t of molybdenum, and the indicated copper resources could reach 10 Mt. Yulong Copper Co. Ltd. was established to handle the operation by Qinghai Western Mining Co. Ltd. (58%), Fujian Zijin Mining Co. Ltd. (22%) Xizang No. 6 Geology and Survey Team (10%); Changdu District State Owned Capital Management and Operation Co. (8%), and Xizang Mining and Development Corp. (2%). The first-phase operation was designed to produce 30,000-t/yr of copper by solvent extraction and electrowinning (SX-EW). The construction of a 10,000-t/yr copper leaching operation was completed in August, and an additional of 20,000-t/yr leaching operation would be completed in 2010. The company planned to have a total refined copper output capacity of 100,000 t/yr. The Yulong deposit had three ore bodies—No. 1, 2, and 5. The No. 1 ore body was sulfide ore, which accounted for 75% of the total reserves. The No. 2 ore body was oxide ore, and the copper content in the ore was as high as 4%. The No. 5 ore body contained both oxide and sulfide ore. The first phase of development was to mine the No. 2 ore body. Also, in Zhag'yab County, Changdu Prefecture, geologists discovered a 1-Mt copper content deposit (Copper and Nickel Monthly, 2008c; China Metal Bulletin, 2009c).

With Government approval to diversify its core operations, Chinalco reached a strategic cooperation agreement with the government of Yunnan Province to acquire a 49% share of Yunnan Copper Group Co. Ltd. Other shareholders were Yunnan Province State Asset Commission (47%), Yunnan Tin Group (2%), and Yunnan Investment Holding Group Co. Ltd. (2%) in 2007. In August 2008, Chinalco changed the name of Yunnan Copper to Chinalco Yunnan Copper Group Co. Ltd. Chinalco's equity at Yunnan Copper increased by 4% in 2008. Yunnan Copper subsidiary Kunpeng Co. Ltd. started the construction of a 100,000-t/yr copper anode plant in Liangshan County, Sichuan Province, in 2008, which included a 300,000-t/yr sulfuric acid plant and a 10,000-t/yr nickel plant. The construction was scheduled to be completed in 2010. Another Yunnan Copper subsidiary, Diqing Mining Co. Ltd., started producing copper cathode by SX-EW method at the Yangla copper mine (China Metals, 2008d).

Shandong Dongying Fangyang Group Co. Ltd. completed the construction of its 100,000-t/yr copper smelter in Dongying, Shandong Province. Jiangxi Copper Co. Ltd. was scheduled to complete the setup of a 50,000-t/yr Kaldo furnace from Outotec Co. of Finland and to expand its smelting capacity to increase the total refined copper output capacity to 900,000 t/yr from

700,000 t/yr in 2009. Ningbo-based Jintian Copper Co. Ltd. was expected to complete the construction of its 120,000-t/yr secondary smelting plant in Yingtan City, Jiangxi Province, in 2009. Hengyang Jinhu planned to build a 50,000-t/yr refined copper plant in Hengyang, Hunan Province. Daye Nonferrous Metals Co. Ltd. planned to double its refined copper output capacity to 400,000 t/yr in 2010. Xinjiang Xinwang Mining Co. Ltd. completed the construction of its 10,000-t/yr blister copper plant in Habahe County, Altay Prefecture, Xinjiang Uygur Autonomous Region, in 2008, and the company planned to join with Tongling Nonferrous Metals Group Holding Co. Ltd. to build a 50,000-t/yr blister copper plant in the same location. Zijin Mining Group started the construction of its 200,000-t/yr copper smelter in Shanghang, Fujian Province. Chifeng Jinjian Copper Co. Ltd., in which Tongling had a 51% equity interest, started the construction of a 100,000-t/yr copper smelter in Chifeng, Nei Mongol Autonomous Region.

Iron and Steel.—According to the State Council's iron and steel stimulus guidelines, crude steel output capacity reached 660 Mt/yr in 2008. The average output capacity of each steel producer was less than 1 Mt/yr. The top five iron and steel producers accounted for 28.5% of the country's total output. Most of the iron and steel producers produced low-value-added products and were located in inland cities. China was required to import high-value-added products. The Government's production target for crude steel in 2009 and 2011 was set at 460 Mt and 500 Mt, respectively, and the consumption of crude steel was set at 430 Mt and 450 Mt, respectively. The Government planned to retire all 300-cubic-meter blast furnaces and 20-t converters and electric arc furnaces (EAF) at yearend 2010 and 400-cubic-meters blast furnaces and 30-t converters and EAF at yearend 2011. Within 3 years, about 72 Mt/yr of ironmaking capacity and 25 Mt of steelmaking capacity would be eliminated. Privately owned iron and steel producers, which used small furnaces and converters for their operations, would be affected most by the Government's stimulus guidelines.

The Government's target was to eliminate all blast furnaces of less than 1,000 cubic meters in the future. The Government urged iron and steel enterprises to merge together in line with the government of Shandong Province's merging of the Province's two leading iron and steel companies—Jinan Iron and Steel Group and Laiwu Iron and Steel Group—to form the Shandong Iron and Steel Group. The newly merged company planned to build a 20-Mt/yr iron and steel plant in the coastal city of Rizhao. The Hebei Provincial government merged Handan Iron and Steel General Work (Hangang) and Tangshan Iron and Steel Co. (Tanggang) to form Hebei Iron and Steel Group.

The Government also urged iron and steel producers to create transregional enterprises, such as Baoshan Iron and Steel (Group) Corp.'s (Baogang Group) acquisition of Hangzhou Iron and Steel Co. and Ningbo Iron and Steel Co. Ltd. in Zhejiang Province and Bayi Iron and Steel Co. in Xinjiang Uygur Autonomous Region. Baogang Group joined with Guangdong Province's iron and steel enterprises to establish the Guangdong Iron and Steel Group Corp. The merger of Wuhan Iron and Steel (Group) Co. (Wugang) and iron and steel enterprises in Guangxi Zhuangzu Autonomous Region was another example. The Government hoped that the consolidation would help the sector's efficiency; increase its bargaining power with suppliers of raw materials; and reduce competition within the sector. The Government planned to withhold 50 Mt of iron ore resources and to distribute them to large- and medium-sized iron and steel enterprises (Ministry of Industry and Information Technology, 2009a).

China was the world's leading producer of pig iron and crude steel. Domestic iron ore production could not meet domestic demand; therefore, China depended on iron ore imports to fill the gap. Imports of iron ore increased to more than 443 Mt in 2008, which was 15% more than in 2007. Australia, Brazil, India, South Africa, and Canada, in descending order of amount imported, were China's key iron ore suppliers. During the past 5 years, the volume of domestic iron ore output increased sharply; owing to the low iron content and high impurities of the ore, pig iron producers preferred imported ore. The iron ore supplied by domestic producers decreased to less than 50% of the demand in 2008 from 75% in the 1990s. About 50% of seaborne ore in the world was destined for China during the past 2 years. Owing to China's increased demand for iron ore, the contract prices of iron ore increased in 4 consecutive years, by 71.5% in 2005, 19.0% in 2006, 9.5% in 2007, and 65.0% to 96.5% in 2008 compared with each of the previous years. Owing to the rising production costs, the prices of domestic iron ore also increased during the past several years. The contract prices of iron ore were expected to decrease in 2009 because of the decrease in demand for steel products throughout the world (General Administration of Customs of the People's Republic of China, 2008).

Owing to the global financial crisis, the demand for steel products decreased sharply in the domestic and international markets during the second half of 2008. Monthly crude steel output decreased to about 38 Mt in December from 47 Mt in June and pig iron output also decreased to 36 Mt in December from 42 Mt in July. As a result, about 90 Mt of imported iron ore was stockpiled at 22 of China's major ports in December. The average price of imported iron ore was $136.20 per metric ton; however, the average market price of deliverable Indian ore at a grade of 63% iron was less than $90 per metric ton in November. Domestic iron ore at a grade of 66% iron decreased to 730 yuan ($107) per metric ton in Hebei Province. China's iron ore mines that were under construction included Baiyunxi by Baotou Iron and Steel and Rare Earth Co., Huoqiu in Anhui Province, Luohe by Ma'anshan Iron and Steel Co., Sijiaying by Tanggang, Xingshan by Shoudu Iron and Steel (Group) Co. (Shougang), and Yuanjiacun by Taiyuan Iron and Steel Co. (Taigang). Jiangxi Geological Survey Institute reported the discovery of a 1-Gt magnetite iron ore deposit on the border of Angren and Cuoqin Counties, Xizang Autonomous Region. The ore grade was in the range of 50% to 60% iron. Hongda Group and Panzhihua Iron and Steel (Group) Co. planned to develop the 3.8-Gt polymetallic iron ore deposit in Yanbian County, Sichuan Province. The iron content of the deposit was in the range of 30% to 50% (China Mining and Metals Weekly, 2008; China Iron and Steel Association, 2009).

Starting on January 1, 2009, China Iron and Steel Association would implement an iron ore import contract agent system to regulate the import price of iron ore. Iron and steel producers would be allowed to import the needed volume. Traders would be allowed to charge 3% to 5% commission. Most of the small iron and steel producers did not participate in the long-term contract system and depended on certified traders to supply iron ore for their operations. The implementation of a contract agent system was expected to balance the supply and demand of iron ore on the domestic market.

The Chinese Securities Regulatory Commission approved the launch of steel futures contracts for rebar and wire rod at the Shanghai Futures Exchange. The wire rod contract would have a daily price change limit of 5%. The minimum deposit would be 7% of the contract value. Each lot would be 10 t with a minimum settlement unit of 300 t (China Economic News, 2009a).

With the Government's encouragement and approval, China's iron and steel producers looked overseas to secure iron ore supplies. China's state-owned iron and steel producers, such as Angang, Baogang, Shagang, Shougang, and Wugang, signed joint-development agreements with companies in Australia, Brazil, Canada, Kyrgystan, and Mongolia. Shougang, through its subsidiaries in Hong Kong, acquired a 40% share of Mount Gibson Iron. Ltd. in Australia. Wugang signed a memorandum of understanding with IronClad Mining Ltd. of Australia to jointly develop the Hercules and the Wilcherry Hill iron ore projects in South Australia. Wugang also acquired a 15% share of Australia's Centrex Metals Co. Discussion was underway between Wugang and Australian-listed Aquila Resources Ltd. to develop four iron ore projects in the Pilbara region in Australia. Wugang also discussed with Admiralty Resources NL of Australia to develop Admiralty's iron ore project in Chile. Angang and Gindalbie Metals Ltd. of Australia formed a 50-50 joint venture to develop the Karara iron ore project in Australia. Minmetals Mining Corp. Ltd., which was a subsidiary of state-owned trading company Minmetals Corp. (Minmetals), discussed with Toronto-listed Macarthur Minerals Ltd. the acquisition of additional share of the Lake Giles project in Australia. Shagang took a 47% share of Australian Bulk Minerals Ltd. (ABM). ABM solely owned the Savage River magnetite iron ore operation in Tasmania and held 70% ownership of the Southdown magnetite project in Western Australia. Sinosteel Corp., which was one of the leading iron ore traders in China, acquired shares of Midwest Corp. Ltd. and Murchison Metals Ltd. of Australia. Mylin Resources Group signed a memorandum of understanding with the Kyrgyzstan Government to prospect and develop the Dzhetym iron ore deposit near the border between Kyrgyzstan and China.

China was one of the fastest growing markets for stainless steel in the world. China's stainless steel production increased to 7.2 Mt in 2007 from 4.6 Mt in 2005. In early 2008, many analysts expected that China's stainless steel output would increase to 9 Mt. Owing to the global financial crisis and weak demand, the output of stainless steel decreased to 6.9 Mt but the output capacity reached 12 Mt/yr in 2008. Of the total output, the Cr-Ni series accounted for 50.6%; Cr series, 26.8%; and Cr-Mn series, 22.6%. In 2008, China imported 1.21 Mt of stainless steel and exported 1.06 Mt. The apparent consumption was about 7.1 Mt in 2008 compared with 7.5 Mt in 2007. Starting on January 1, 2008, the Government increased the tariff to 10% from 5% on hot-rolled stainless steel coil with a thickness of less than 4.75 millimeters (mm) and hot-rolled stainless steel plate with a thickness less than 3 mm. The export volume of these products decreased by more than 50% in 2008 compared with the volume in 2007. As a result, many small downstream stainless steel producers shut down their operations, especially in the coastal areas, during the second half of 2008. The leading stainless steel producers were, in order of production capacity, Taigang, Baogang, Jiuquan Iron and Steel Co. Ltd., Zhangjiagang Pohang Iron and Steel Co., and Yieh United Iron and Steel Co. (China Metals, 2009a).

Nickel.—The production of stainless steel accounted for more than 60% of total nickel consumption, and electroplating accounted for 15%. The ferroalloy and battery sectors accounted for 8% and 5% of nickel consumption, respectively. Owing to the global financial crisis, China's stainless steel production and exports of nickel products decreased in 2008. The decrease in the export of nickel products was also caused by the Government's introduction of a 15% tariff rate on refined nickel exports and by the ban on processing trade of imported nickel concentrates in 2008. The Government planned to eliminate the ban on nickel processing trade on February 1, 2009. China's apparent consumption of nickel was about 378,000 t in 2008 (Copper and Nickel Monthly, 2009).

In China, nickel metal was produced from hydrometallurgical and pyrometallurgical processes. Before 2004, nickel metal was produced solely by the pyrometallurgical process, and the output of Jinchuan Nonferrous Metal Corp. accounted for 80% of the country's total. Owing to an increase in stainless steel production, the demand for nickel increased by more than 20% per year during the past 4 years. Because of limited nickel resources, China imported a large quantity of nickel from overseas, mainly from Indonesia, New Caledonia, and the Philippines. In 2008, China imported 12,318,022 t of nickel ore and concentrate, 25,253 t of nickel matte, and 9,600 t of refined nickel. Most of the imported ore was laterite ore, which contained less than 2% nickel. Between 2005 and 2007, the laterite was mainly used to produce nickel pig iron to substitute for the use of nickel metal in stainless steel production. During that period, prices of refined nickel on the domestic and international markets reached more than $20,000 per metric ton and domestic nickel pig iron producers expanded their operations. The price of refined nickel started to decline in June 2008, and the price of domestic refined nickel decreased to 86,000 yuan ($12,600) per metric ton in December from 240,000 yuan ($35,300) per metric ton in January. The nickel pig iron production was energy-intensive, and the average production cost was 60,000 yuan ($8,800) per metric ton. The nickel content in nickel pig iron was in the range of 2% to 5% and some might be as high as 8%. The nickel content in nickel pig iron can be used for the production of low-level nickel stainless steel products and for other products, which requires the addition of nickel metal to increase the nickel content. When the price of refined nickel decreased, many nickel pig iron producers shut down their operations because of the high production costs. Therefore, about 7.8 Mt of laterite ore was stockpiled in domestic ports at yearend (China Metal Bulletin, 2008a, 2009b).

In 2008, two Chinese companies employed acid leaching hydrometallurgy technology to produce electrolytic nickel from imported laterite ore. Jiangxi Jiangli New-Type Materials Co. Ltd.'s 10,000-t/yr-capacity nickel plant was located in Fenyi County, Jiangxi Province. Jiangli planned to expand nickel output to 100,000 t/yr in the future. Guangxi Yulin Weinie Co. Ltd. commissioned its stage one 5,000 t/yr nickel plant in June, and stage two would be completed in 2009. After completion, the company would have a total output capacity of 18,000 t/yr. The plant was located in Bobai County, Guangxi Zhuangzu Autonomous Region (Copper and Nickel Monthly, 2008a, b).

Vale Inco Ltd. of Canada invested $63 million to build a nickel plant in Dalian, Liaoning Province. The plant was designed to produce 32,000 t/yr of Utility® nickel (a refined form of nickel), which was developed by Inco for use in the stainless steel sector. The construction of the plant was completed in 2008. Inco subsidiaries Korea Nickel Corp. and Taiwan Nickel Refining Corp. also produced this kind of nickel. The plant would be owned and operated by Vale Inco New Nickel Materials (Dalian) Co. Ltd., which was a Sino-foreign joint-venture company in which Inco held a 98% equity share and Ningbo Sunhu Chemical Products Co. Ltd. held a 2% share. Raw material would be supplied from Inco's Goro nickel project in New Calendonia (Vale Inco Ltd., 2007).

Industrial Minerals

Cement.—China was the leading cement producing country in the world and accounted for almost 50% of the world's total. Even with the Government's restricted investment policy for the cement sector, cement output continued to increase. In 2008, the total investment in the cement sector was $15 billion. The output capacity of cement increased by 150 Mt/yr, which was the highest rate increase since 2001. The per capita consumption of cement increased to about 1,000 kg in 2007 from 200 kg in 1990. Cement production was an energy-intensive industry, and the Government did not encourage exporting large amounts of cement. Therefore, the Government reduced the VAT export rebate to 11% from 13% in September 2006 and to 0% in July 2007. Cement exports decreased to 13.2 Mt in 2008 from 33.0 Mt in 2007 and 36.1 Mt in 2006 (China Cement Association, 2009).

During the past several years, the Government ordered cement producers to close down plants that used obsolete technology and encouraged cement producers to reshuffle the cement sector through mergers, regroupings, and takeovers. There were more than 6,000 cement producers in China in 2005, and the Government set the target of reducing the number of cement producers to 3,500 by 2010. In 2008, the use of dry rotary kilns for cement production increased to 61% from 14% in 2004 and was expected to increase to 70% in 2009. The use of a dry rotary kiln to produce 1 t of clinker consumed 115 kg of standard coal; a vertical kiln, 160 kg; and a wet kiln, 208 kg. About 70 Mt of obsolete production capacity was eliminated in 2007. China's demand for cement was expected to increase by 6% per year through 2012. The central and eastern parts of the country would remain the leading cement markets because of the increase in regional construction expenditures. The northwestern and southwestern parts of China were expected to grow faster than in previous years because of the Government's development strategy for the western part of the country. Nonresidential construction would continue to be the leading end use for cement (China Construction News, 2008).

Lithium.—China had some of the largest lithium resources in the world. The country has abundant salt lakes, which accounted for 80% of the country's total lithium resources; however, most of the lakes are located in the western part of the country. Infrastructure in those areas was relatively undeveloped. Before 2004, the country's lithium carbonate was produced from either domestic or imported spodumene. The process required a large amount of energy because the grounded ore was calcined to 1,100° C. Purification was another technical challenge for this process. During the past decade, domestic scientists worked with foreign experts to develop technology to extract lithium from saline sources that contained high levels of dissolved magnesium ion. China's lithium carbonate output capacity was estimated to be about 20,000 t/yr in 2007. Lithium salts were used by battery, glass, ceramics, and lubricant sectors, of which the lithium battery industry had the fastest growth among these industries during the past decade, and this growth was expected to increase significantly in the future. China's demand for lithium salt has grown rapidly during the past several years, and lithium salt output capacity was expected to increase to 60,000 t/yr in 2010 (China Chemical Reporter, 2009).

Xizang (Tibet) Mining Co.'s subsidiary Zabuye Lithium High-Tech Co. Ltd. planned to expand its lithium salt output capacity by 20,000 t/yr. Zabuye Lake is located 4,421 meters above sea level in the north of Zhongba County, Rikaze District, which is located 1,050 km west of Lhasa, Xizang Autonomous Region. The total area of the lake was 247 square kilometers, and the brine contained 1,527 milligrams per liter of lithium. The lithium content of Zabuye was three times that at Dongtaijnaier Lake in Qinghai Province. In 2004, Zabuye had an output capacity of 7,500 t/yr of salt, which contained about 75% lithium carbonate. The salt was shipped to Baiyin Zabuye Lithium Co. Ltd. (a subsidiary of Zabuye), which was located in Baiyin, Gansu Province, for further separation and purification. The plant had an output capacity of 5,000 t/yr of lithium salt (3,000 t/yr of lithium carbonate and 2,000 t/yr of lithium hydroxide). Zabuye also planned to increase the separation plant output capacity to 25,000 t/yr. The total investment was estimated to be $161 million. In 2008, Zabuye produced a total of 1,556 t of lithium carbonate and lithium hydroxide (China Chemical Reporter, 2009).

Galaxy Resources Ltd. signed a letter of intent with the local government to build a lithium carbonate plant in the Yangtze River International Chemical Industrial Park at Zhangjiagang, Jiangsu Province. Galaxy awarded a contract to Hatch Consulting Shanghai Co. Ltd. to perform a definitive feasibility study. The Urumqi Engineering and Research Institute of Nonferrous Metals would assist Hatch in this study. The raw material (spodumene) would come from Galaxy's Mount Cattlin lithium deposit in Ravensthorpe, Australia (Galaxy Resources Ltd., 2009).

Rare Earths.—China was rich in rare-earth resources and the country produced different kinds of rare-earth products. Since the 1990s, China had become the leading rare-earth supply country in the world. During the past decade, China's rare-earth production accounted for about 90% of the world total. Rare-earth consumption in China had increased steadily. The country consumed about 73,000 t of rare earths in 2007 and 68,000 t in 2008 compared with 19,300 t in 2000. Rare earths was a strategic commodity in China. Foreign investors were prohibited from mining rare earths and were restricted from participating in rare-earth smelting and separation projects. Although China's total output capacity was huge, the average capacity for each producer was small. As a result, the profitability was low and the product quality was inconsistent between different shipments. Because of oversupply of rare-earth products in domestic markets, producers exported their products at prices that were less than their production costs, and they depended on the export VAT rebate to make up the difference to become profitable. In 2005, the Government cancelled the export VAT rebate and levied an export tariff of 25% on some rare-earth products (China Metal Bulletin, 2009d).

The dominant position of China's rare earths in the world was expected to become more important because of the wide range of cutting-edge environmental technology, such as wind turbines, low-energy light bulbs, and hybrid cars, that depend on rare-earth metals. Owing to an increase in domestic demand, the Government gradually reduced the export quota during the past several years. In 2008, domestic rare-earth producers were allocated a total of 34,156 t (in rare-earth oxide content), of which the first batch was 22,780 t and the second batch was 11,376 t. Sino-foreign joint-venture rare-earth producers were allocated a total of 8,210.5 t in 2008. The Government approved 23 domestic rare-earth producers and traders to have the right to perform rare-earth trading in China. Only 20 domestic rare-earth producers and traders were awarded export rights, and the first batch export quota was reduced to 16,043 t in 2009. Sino-foreign rare-earth producers were allowed to export a total of 6,685.1 t in 2009 (Ministry of Commerce, 2008d).

In 2002, the State Council approved the restructuring of the domestic rare-earth sector and the establishment of two regional groups—China Northern Rare Earth Group Co. and China Southern Rare Earth Group Co. Owing to the reluctance of local governments and rare-earth producers, the establishment of the two groups was unsuccessful. During the past several years, the Government continued to urge rare-earth producers to merge into several large groups and to eliminate duplicate projects. Rare-earth producers realized that the bitter competition among each other was causing financial losses and that integrating the rare-earth producers could benefit the rare-earth sector in China. In 2007, Rare Earth Hi-Tech Co. changed its name to Baotou Rare Earth Co. and started to discuss with other rare-earth producers in the Nei Mongol Autonomous Region the possibility of forming Baotou Rare Earth International Trading Co. and establishing a rare-earth concentrates reserve base in the Region. Mianning County in Sichuan Province was China's second ranked rare-earth producing base. In 2007, the local government shut down mining activities in Mianning County because miners were using obsolete technology to exploit and process rare earths and were causing environmental damage in the county. In 2008, Jiangxi Copper Corp. obtained rare-earth mining rights in Maoniuping, Mianning County, and planned to use advanced mining and processing technology to produce rare earths (Precious and Minor Metals Monthly, 2008).

Dingnan Dahua New Materials Co. Ltd., Ganxian Hongjin Rare Earth Co. Ltd., and Minmetals Nonferrous Metals Co. Ltd. formed a joint-venture company, Minmetals Ganzhou Rare Earth Co. Ltd., to process rare-earth resources in Ganzhou, Jiangxi Province, in 2008. Most of China's ion-absorption type of rare earths was located in Ganzhou. There were 88 rare-earth producers in Ganzhou, and 90% of them ceased their operations because of weak prices. Jiangxi Province had an ion-absorption type of rare earths reserve of 2.3 Mt. Minmetals Ganzhou Rare Earth had a rare-earth separation capacity of 8,500 t/yr and planned to expand the separation capacity to 13,500 t/yr within 5 years. The joint venture also planned to develop value-added rare-earth products for the aerospace and electronics sectors (China Chemical Reporter, 2008).

China Nonferrous Metal Industry's Foreign Engineering and Construction Co. Ltd. (CNMI), Fengyuan Development Co. Ltd., Jiangsu Zhuoqun Nano Rare Earth Co. Ltd., and Shengchang Rare Earth Material Co. Ltd. jointly established a rare-earth company—China Nonferrous South Rare Earth (Xinfeng) Co. Ltd.—to build a 7,000-t/yr rare-earth separation plant in Shaoguan, Guangdong Province. Rare-earth operations at CNMI's Zhujiang Smelter in Guangzhou, Guangdong, Shengchang, and Zhuo Quo would be shut down when the Xinfeng plant started operation. The Government approved the establishment of the new company and the relocation plan of the Zhujiang smelter (China Nonferrous Metals, 2009b).

Guangdong Guangsheng Nonferrous Metals (Group) Co. Ltd.'s subsidiary Guangcheng Nonferrous Metals Co. Ltd. was the sole legal rare-earth mining company in Guangdong Province. The Government approved Guangcheng's application to list on the stock exchange and to consolidate eight rare-earth mining, smelting, and processing companies and five tungsten mining companies in Guangdong. Guangcheng had a rare-earth smelting and separation capacity of 8,000 t/yr (China Nonferrous Metals, 2009b).

China's companies were looking for rare-earth investments overseas. East China Exploration planned to acquire a 25% interest in Australia's Arafura Resources Ltd., which had the Nolans rare-earths–phosphate–uranium project in Northern Territory, Australia. China Nonferrous Metals Mining (Group) Co. Ltd. agreed to acquire a 51.6% interest at Lynas Corp. Ltd. Lynas's Mount Weld rare-earth mining project was under construction in Western Australia. If the transaction is completed, China would continue to be the globally dominant player in the rare-earth industry in the future (China Mining and Metals Weekly, 2009c).

Mineral Fuels

Coal.—China has undergone significant economic reform and has one of the world's fastest growing economies. Coal consumption has increased to meet the high demand for industrial production and power generation. Coal was the primary source of energy—two-thirds of the country's electricity was produced by coal-fired plants. About 50% of the country's total coal output was consumed by the power sector.

During the first 8 months of 2008, demand for coal was high, and the country faced a severe shortage of coal in the Provinces of Guizhou, Henan, Jiangxi, and Qinghai. The per metric ton price of 5,500-kilocalorie coal increased to more than 1,000 yuan ($147) at Qinhuangdao Port, which the country's major coal transshipment port. Beginning in September, because of the global financial crisis, the demand for electricity declined. The price of coal also decreased to less than 600 yuan ($88) per metric ton. At yearend, the country stockpiled about 200 Mt of coal, which was an increase of 35% compared with the amount stockpiled in 2007, of which 50.9 Mt was stored at the coal mine's warehouses; 43.3 Mt at powerplants; and 19.7 Mt at major port warehouses. The average coal selling price of major coal producers was 356.3 yuan ($54) per metric ton and the production cost was 338.5 yuan ($50) per metric ton. In 2008, the total fixed investment of the coal sector was $35 billion. According to the China Coal Association, the country produced 27.16 Gt of coal, which was higher than that reported by the China Coal Trade and Development Association (26.9 Gt) and the NDRC (26.2 Gt). Owing to increased domestic demand, China's coal exports decreased to 45.43 Mt in 2008 from 53.17 Mt in 2007 to (in descending order by volume of exports) the Republic of Korea, Japan, and Taiwan. Coal imports decreased to 40.40 Mt in 2008 from 51.02 Mt in 2007, and were mainly from (in descending order by volume of imports) Vietnam, Indonesia, Mongolia, Australia, and North Korea (National Development and Reform Commission, 2009; Wang, 2009).

In the 1990s, the Government allowed coal producers to sell their products at market prices; however, the price of steam coal for powerplants was negotiated between coal producers and powerplant operators yearly under the Government guidelines; the coal was known as "planned coal." The Government set the price of electricity. In 2006, the Government allowed coal producers and powerplant operators to negotiate coal prices. In 2007 and 2008, the price of steam coal increased on the domestic and international markets, but the Government adjusted the electricity price only slightly. Owing to increased production costs, coal producers were unwilling to lower the price of coal, and power companies were not allowed to increase the electricity price. As a result, power companies faced significant financial losses during the past 2 years. In 2008, power companies and coal producers could not agree on the price of steam coal for 2009, and no contract was signed during the negotiation period. Eventually, under the Government's guidance, China's six leading power companies and coal producers agreed that the price of coal would be 10 yuan for every 100 kilocalorie, an increase of about 10% from that of the previous year. China's National Energy Administration (NEA) was the energy management agency; it did not oversee state-owned power companies, which were under the State-owned Assets Supervision and Administration Commission. The NEA's recommendation would be an important factor in the State Council's decision to approve negotiated contracts, however (China Energy Weekly, 2009c).

Shanxi Province was China's leading coal producing Province, and its coal output accounted for more than 20% of the country's total coal output. The Shanxi coal reserve ranked third after Xinjiang Uygur Autonomous Region and Nei Mongol Autonomous Region. The government of Shanxi Province planned to consolidate state-owned coal producers into five enterprises—Datong Coal Mine Group, Jincheng Bituminous Coal Group, Lu'an Mining Group, Shanxi Coking Coal Group, and Yangquan Coal Industry Group—and China Coal Pingshuo Co., which was a subsidiary of China National Coal Group Corp. The enterprises would acquire surrounding coal producers. By yearend 2010, Shanxi would have four coal enterprises that each would have a coal output capacity of more than 50 Mt/yr and three coal enterprises that would have an output capacity of more than 100 Mt/yr each. These enterprises would account for 75% of Shanxi's total coal output. The total number of shafts in the Province would be less than 1,000 in 2011 from 2,600 in 2008, and each of them would have an output capacity of greater than 3 Mt/yr. The government of Shanxi Province encouraged locally owned coal producers to merge with other coal producers to create larger companies. The government of Henan Province also planned to consolidate its state-owned coal miners into two large enterprises. Nei Mongol Autonomous Region could replace Shanxi Province as the leading coal producing province in China by 2012. About 90 Mt/yr of coal output capacity was expected to be put into operation in 2009 (China Metal Bulletin, 2008b).

Outlook

Even while recovering from a series of natural disasters and the global financial crisis, China's economy is expected to continue to grow in the near future. The Government set the economic growth rate target at 8% during next 2 years. The Government recognizes that the country cannot depend solely on exports to sustain its economic growth and that the country needs to increase domestic consumption and to have a more-transparent financial and legal system. The sustainability of China's economic growth implies that strong demand for mineral commodities is likely to continue. China has shortages in the supply of most major minerals, such as bauxite, chromium, copper, iron, lead, manganese, nickel, oil, and potash, and relies on imports to meet the demand. This trend is expected to continue. The Government therefore encourages enterprises to invest in such mineral-rich countries as Australia, Brazil, Burma, Chile, Indonesia, and Mongolia to secure minerals for domestic economic development and growth. The Government has been promoting a reduction in resource dependency and the production of higher-value-added downstream products. The Government has not yet achieved great success in meeting this goal. As progress is made toward this goal, the country's dependence on most major mineral commodities could decline. For the near term, however, China will likely continue to play an important role in the world's metal and mineral markets. Also, China's overseas investments will probably become a major phenomenon until the transition to resource independence takes place. China's overall outward investment is expected to continue to increase and may soon exceed inward foreign direct investment.

The environmental, health, safety, and social performance of mining and metal enterprises is of concern to the Government.

The Government has set guidelines for the development of these enterprises in an attempt to improve protection of the environment. Owing to ineffective enforcement through supervision and monitoring, however, progress has been slow. The Government plans to continue its effort to address the sustainable development of the mining and metal sectors through air and water pollution prevention and treatment, land protection, mine safety, and reclamation of mine sites.

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TABLE 1

CHINA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
METALS						
Aluminum:						
Bauxite, gross weight	thousand metric tons	17,000	22,000	27,000	30,000	35,000
Alumina	do.	6,990	8,540	13,700	19,500	22,800
Metal, refined:						
Primary	do.	6,900	7,800	9,360	12,600	13,200
Secondary	do.	1,660	1,940	2,350	2,750	2,700
Total	do.	8,560	9,740	11,700	15,400	15,900
Antimony:						
Mine, Sb content		125,000	152,000	153,000	163,000	166,000
Metal		125,000	138,000	140,000	147,000	183,000
Bismuth:						
Mine output, Bi content		3,000	3,000	1,520	3,500	5,000
Metal		11,700	10,600	11,800	12,100	12,000
Cadmium, smelter		4,530	4,080	3,790	4,210	4,300
Chromite, gross weight	thousand metric tons	200	200	200	200	200
Cobalt:						
Mine output, Co content		1,260	2,100	1,840	6,100	6,000
Metal		5,600	7,150	8,200	7,580	7,600
Copper:						
Mine output, Cu content		742,000	762,000	873,000	928,000	940,000
Metal:						
Smelter, primary	thousand metric tons	1,500	1,750	1,920	2,110	2,500
Refined:						
Primary	do.	1,580	1,850	2,000	2,400	2,700
Secondary	do.	620	750	1,000	1,200	1,400
Total	do.	2,200	2,600	3,000	3,600	4,100
Gold, mine output, Au content		215	225	245	275	285
Indium		200	300	350	320	310
Iron and steel:						
Iron ore, gross weight	thousand metric tons	320,000	420,000	601,000	707,000	824,000
Pig iron	do.	251,850 [4]	343,750 [4]	412,450 [4]	476,520 [4, r]	470,670 [4]
Ferroalloys	do.	8,670	10,700	14,300	17,500	18,300
Steel, crude	do.	272,800 [4]	353,240 [4]	419,150 [4]	489,290 [4, r]	500,490 [4]
Steel, rolled	do.	297,230 [4]	377,710 [4]	468,930 [4]	565,610 [4, r]	584,770 [4]

See footnotes at end of table.

TABLE 1—Continued
CHINA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
METALS—Continued						
Lead:						
Mine output, Pb content		998,000	1,140,000	1,330,000	1,410,000	1,550,000
Metal:						
Smelter, primary		1,460,000	1,790,000	2,090,000	2,040,000	2,200,000
Refined						
Primary		1,510,000	1,850,000	2,130,000	2,140,000 [r]	2,350,000
Secondary		430,000	537,000	590,000	650,000 [r]	850,000
Total		1,940,000	2,390,000	2,720,000	2,790,000 [r]	3,200,000
Magnesium, metal and alloy		442,000	470,000	520,000	625,000	559,000
Manganese:						
Ore, Mn content	thousand metric tons	1,100	1,500	1,600	2,000	2,200
Metal		492,000	566,000	730,000	1,000,000	950,000
Mercury, mine output, Hg content		1,140	1,100	760	800	800
Molybdenum, mine output, Mo content		38,500	40,000	43,900	67,700	81,000
Nickel:						
Mine output, Ni content		75,600	72,700	82,100	67,000 [r]	72,000
Matte		74,000	83,500	99,800	105,000	110,000
Smelter		75,800	95,100	102,000	116,000	129,000
Niobium and tanlatum, mine output:						
Nb_2O_5 content		105	110	120	270	300
Ta_2O_5 content		320	310	440	920	900
Silicon, metal		750,000	840,000	900,000	950,000	980,000
Silver, mine output, Ag content		2,450	2,500	2,600	2,700	2,800
Tin:						
Mine output, Sn content		118,000	126,000	126,000	146,000	110,000
Metal		115,000	122,000	132,000	149,000	129,000
Titanium:						
Ilmenite, TiO_2 equivalent		420,000	450,000	500,000	550,000	550,000
Sponge		4,810	9,160	18,100	42,000	44,300
Tungsten, mine output, W content		59,900	51,200	45,000	41,000	43,500
Vanadium, in vanadiferous slag product		40,000	42,500	42,500	45,200	46,000
Zinc:						
Mine output, Zn content	thousand metric tons	2,390	2,550	2,840	3,040	3,200
Refined, primary and secondary	do.	2,720	2,780	3,170	3,740	4,000
INDUSTRIAL MINERALS						
Asbestos		400,000	400,000	360,000	390,000 [r]	380,000
Barite	thousand metric tons	3,900	4,200	4,400	4,400	4,600
Bentonite	do.	3,000	3,100	3,200	3,300	3,300
Boron, mine, B_2O_3 equivalent		135,000	140,000	145,000	145,000	140,000
Bromine		80,000	104,000	124,000	130,000	135,000
Cement, hydraulic	thousand metric tons	970,000 [4]	1,068,850 [4]	1,236,770 [4]	1,361,170 [4, r]	1,388,380 [4]
Diatomite		390,000	410,000	420,000	420,000	440,000
Dolomite	thousand metric tons	7,500	7,800	8,000	8,000	8,000
Feldspar	do.	1,800	1,900	1,950	2,000	2,000
Fluorspar	do.	2,700	2,800	3,000	3,200	3,250
Graphite		700,000	720,000	720,000	800,000	800,000
Gypsum	thousand metric tons	29,000	32,000	4,200 [r]	4,800 [r]	4,600
Kaolin	do.	7,000 [r]	7,720 [r]	7,520 [r]	7,380 [r]	3,850
Lime	do.	140,000	150,000	160,000	170,000	175,000
Lithium minerals, all types		18,000	19,000	20,000	22,000	25,000
Magnesite	thousand metric tons	6,500	6,600	6,700	8,000	10,000
Nitrogen, N content of ammonia	do.	34,770 [4]	37,850 [4]	40,660 [4]	42,480 [4]	41,140 [4]
Phosphate rock, P_2O_5 equivalent	do.	7,650	9,130	11,600	15,100	15,200
Potash, marketable, K_2O equivalent	do.	770	1,500	1,800	2,600 [r]	2,750

See footnotes at end of table.

TABLE 1—Continued

CHINA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
INDUSTRIAL MINERALS—Continued						
Rare earths, rare-earth oxide equivalent		98,000	119,000	133,000	120,000	125,000
Salt	thousand metric tons	37,100 [4]	46,610 [4]	56,630 [4]	59,760 [4]	59,520 [4]
Sodium compounds:						
Mirabilite	do.	6,300	6,300	6,500	6,600	6,600
Soda ash, natural and synthetic	do.	13,024 [4]	14,211 [4]	15,600 [4]	17,650 [4, r]	18,540 [4]
Strontium carbonate		270,000	300,000	320,000	330,000	335,000
Sulfur:						
Native	thousand metric tons	820	900	950	960	960
Content of pyrite	do.	3,730	4,010	3,810	4,200	4,300
Byproduct, all sources	do.	2,600	2,800	3,000	3,300	3,350
Total	do.	7,150	7,710	7,760	8,460	8,610
Talc and related materials	do.	2,200	2,300	2,400	2,000 [r]	2,200
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Anthracite	thousand metric tons	464,000	487,000	442,000 [r]	450,000 [r]	460,000
Bituminous	do.	1,450,000	1,670,000	1,780,000 [r]	2,000,000 [r]	2,150,000
Lignite	do.	80,000	98,000	105,000 [r]	100,000 [r]	110,000
Total	do.	1,990,000	2,260,000	2,330,000 [r]	2,550,000	2,720,000
Coke, all types	do.	177,480 [4]	232,820 [4]	280,540 [4]	328,940 [4]	323,590 [4]
Gas, natural:						
Gross	billion cubic meters	41	50	59	62	76
Marketed	do.	34	42	51	52	66
Petroleum:						
Crude, including crude from oil shale	million 42-gallon barrels	1,300	1,320 [r]	1,350 [r]	1,360 [r]	1,380
Refinery products	do.	2,600	2,800	3,000	3,500	3,500

[r] Revised. do. Ditto.

[1] Estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2] Table includes data available through June 30, 2009.

[3] China also produces diamond, gallium, germanium, platinum-group metals, stone, and uranium, but available information is inadequate to make reliable estimates of output.

[4] Reported by China's State Statistical Bureau.

TABLE 2
CHINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies[1]	Location of main facilities[2]	Annual capacity[e]
Aluminum:			
Alumina	Chongqing Dingtai Tuoyuan Alumina Co.	Chongqing	150
Do.	Nanchuan Pioneer Alumina Co.	do.	200
Do.	Pingguo Aluminum Co. [Aluminum Corporation of China (Chinalco)]	Guangxi, Pingguo	1,200
Do.	Guizhou Aluminum Plant [Aluminum Corporation of China (Chinalco)]	Guizhou, Guiyang	1,200
Do.	Guanxiangxia Aluminum Co. Ltd.	Hebei, Yicheng	200
Do.	Luoyang Wanji Xiangjiang Aluminum Co. Ltd.	Henan, Luoyang	800
Do.	Yixiang Aluminum Co. (Henan Yima Coal Group)	Henan, Mainchi	600
Do.	Pingdingshan Huiyuan Chemical Co.	Henan, Pingdingshan	300
Do.	Yangquan Coalmine Aluminum (Sanmenxia) Co. Ltd.	Henan, Sanmenxia	1,200
Do.	East Hope (Sanmenxia) Aluminum Co. Ltd.	do.	1,200
Do.	Zhengzhou Aluminum Plant [Aluminum Corporation of China (Chinalco)]	Henan, Zhengzhou	2,600
Do.	Zhongzhou Aluminum Plant [Aluminum Corporation of China (Chinalco)]	Hunan, Zhongzhou	3,000
Do.	Bingzhou Weiqiao Aluminum Co.	Shandong, Zouping	1,600
Do.	Shandong Huayu Alumina Co. Ltd. (Shandong Chiping Xinfa Aluminum and Electricity Group)	Shandong, Chiping	1,800
Do.	Shandong Aluminum Plant [Aluminum Corporation of China (Chinalco)]	Shandong, Zibo	1,500
Do.	Shanxi Aluminum Plant [Aluminum Corporation of China (Chinalco)]	Shanxi, Hejin	2,200
Do.	Shanxi Luneng Jinbei Aluminum Co. Ltd.	Shanxi, Yuanping	1,000
Metal	Baiyin Aluminum Plant	Gansu, Baiyin	150
Do.	Lanzhou Aluminum Plant	Gansu, Lanzhou	210
Do.	Liancheng Aluminum Plant	do.	235
Do.	Yinhai Aluminum Co. Ltd.	Guangxi, Laibin	125
Do.	Pingguo Aluminum Co. [Aluminum Corporation of China (Chinalco)]	Guangxi, Pingguo	380
Do.	Guizhou Aluminum Plant [Aluminum Corporation of China (Chinalco)]	Guizhou, Guiyang	400
Do.	Chalco Zunyi Aluminum Co. Ltd.	Guizhou, Zunyi	130
Do.	Henan Zhongfu Industry Co. Ltd.	Henan, Gongyi	180
Do.	Jiaozuo Wanfang Aluminum Co. Ltd.	Henan, Jiaozuo	420
Do.	Henan Wanji Aluminum Co. Ltd.	Henan, Luoyang	180
Do.	Henan Zhongmai Mianchi Aluminum Plant	Henan, Mianchi	400
Do.	Sanmenxia Tianyuan Aluminum Co. Ltd.	Henan, Sanmenxia	110
Do.	Shangqiu Aluminum Smelter	Henan, Shangqiu	180
Do.	Yichuan Yugang Longquan Aluminum Co.	Henan, Yichuan	600
Do.	Henan Shenhuo Aluminum-Electricity Co. Ltd.	Henan, Yongcheng	200
Do.	Zhengzhou Aluminum Plant [Aluminum Corporation of China (Chinalco)]	Henan, Zhengzhou	60
Do.	Hanjiang Danjiangkou Aluminum Co. Ltd.	Hubei, Danjiangkou	110
Do.	Hunan Chuanquan Aluminum Co. Ltd.	Hunan, Taoyuan	210
Do.	Fushun Aluminum Plant	Liaoning, Fushun	190
Do.	Baotou Aluminum Plant	Nei Mongol, Baotou	250
Do.	East Hope Aluminum Plant	do.	330
Do.	Qingtongxia Aluminum Plant	Ningxia, Qingtongxia	580
Do.	Qiaotou Aluminum Co. Electrolysis Branch	Qinghai, Datong	350
Do.	Qinghai Aluminum Smelter [Aluminum Corporation of China (Chinalco)]	Qinghai, Xining	560
Do.	Qinghai West Mining Baihe Aluminum Co. Ltd.	do.	112
Do.	Tongchuan Xingguang Aluminum Co. Ltd.	Shaanxi, Tongchuan	250
Do.	Shandong Chiping Xinfa Aluminum and Power Group	Shandong, Chiping	360
Do.	Taishan Aluminum-Power Co. Ltd.	Shandong, Fecheng	125
Do.	Shandong Nanshan Industry Co. Ltd.	Shandong, Longkou	280
Do.	Shandong Aluminum Plant [Aluminum Corporation of China (Chinalco)]	Shandong, Zibo	120
Do.	Bingzhou Weiqiao Aluminum Co.	Shandong, Zouping	250
Do.	Zouping Aluminum Co. Ltd.	do.	150
Do.	Huaze Aluminum and Power Co. Ltd.	Shanxi, Hejin	400
Do.	New Orient Aluminum Co. Ltd.	Shanxi, Taiyuan	75
Do.	Shanxi Guanlu Aluminum Co. Ltd.	Shanxi, Yuncheng	210
Do.	Yunnan Aluminum Plant	Yunnan, Kunming	500

See footnotes at end of table.

TABLE 2—Continued
CHINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies[1]	Location of main facilities[2]	Annual capacity[e]
Antimony		Huaxi (China Tin) Group Industrial Co.	Guangxi, Hechi	25
Do.		Xikuangshan Twinkling Star Co. Ltd.	Hunan, Lengshuijiang	37
Asbestos		China National Nonmetallic Industry Corp.	Nei Mongol, Baotou; Shanxi, Lai Yuan and Lu Liang	130
Barite		do.	Guizhou, Xiangshou	NA
Bismuth	metric tons	Guangzhou Smelter	Guangdong,Guangzhou	300
Do.	do.	Hunan Bismuth Industry Co. Ltd.	Hunan, Chouzhou	3,500
Do.	do.	Shizhuyuan Nonferrous Metals Co. Ltd.	Hunan, Shizhuyuan	1,200
Do.	do.	Zhuzhou Smelter (Zhuye Torch Metals Co. Ltd.)	Hunan, Zhuzhou	350
Do.	do.	Yunnan Copper Group Co. Ltd.	Nei Mongol, Chifeng	300
Cadmium		Zhuzhou Smelter (Zhuye Torch Metals Co. Ltd.)	Hunan, Zhuzhou	1
Coal		Hebei Provincial Government	Hebei	70,000
Do.		Heilongjiang Provincial Government	Heilongjiang	100,000
Do.		Henan Provincial Government	Henan	100,000
Do.		Liaoning Provincial Government	Liaoning	70,000
Do.		Nei Mongol Provincial Government	Nei Mongol	90,000
Do.		Shandong Provincial Government	Shandong	60,000
Do.		Shanxi Provincial Government	Shanxi	400,000
Do.		Sichuan Provincial Government	Sichuan	80,000
Do.		Shenhua Coal Corp.	Ningxia, Nei Mongol, and Shaan	150,000
Cobalt	metric tons	Jinchuan Nonferrous Metals Corp.	Gansu, Jinchang	1,200
Do.	do.	Huayou Cobalt Co. Ltd.	Zhejiang, Tongxiang	3,000
Copper, refined		Jinchang Smelter (Tongling Nonferrous Metals Group Holding Co. Ltd.)	Anhui, Tongling	170
Do.		Jinlong Smelter (Tongling Nonferrous Metals Group Holding Co. Ltd.)	do.	400
Do.		Wuhu Smelter (Hengxin Copper Industry Group Co.)	Anhui, Wuhu	60
Do.		Baiyin Nonferrous Metals Co.	Gansu, Baiyin	50
Do.		Jinchuan Nonferrous Metals Corp.	Gansu, Jinchuan	400
Do.		Luoyang Copper Processing Factory	Henan, Luoyang	50
Do.		Daye Nonferrous Metals Co.	Hubei, Daye	200
Do.		Zhangjiagang United Copper Co. (Tongling Nonferrous Metals Group Holding Co. Ltd.)	Jiangsu, Zhangjiagang	200
Do.		Guixi Smelter (Jiangxi Copper Co. Ltd.)	Jiangxi, Guixi	900
Do.		Dongfang Copper Co. (Huludao Nonferrous Metals Group)	Liaoning, Huludao	100
Do.		Chifeng Jingeng Copper Co. Ltd.	Nei Mongol, Chifeng, Harqin Banner	100
Do.		Dongying Fangyuan Nonferrous Metals Co. Ltd.	Shandong, Dongying	200
Do.		Shandong Jinsheng Nonferrous Metals Corp.	Shandong, Linyi	100
Do.		Shandong Yanggu Xiangguang Co. Ltd.	Shandong, Yanggu	400
Do.		Yantai Penghui Copper Industry Co. Ltd.	Shandong, Yantai	200
Do.		Taiyuan Copper Industry Co.	Shanxi, Taiyuan	30
Do.		Zhongtiaoshan Nonferrous Metals Co.	Shanxi, Yuangu	100
Do.		Tianjin Datong Copper Co. Ltd. (formerly Tianjin Copper Electrolysis Factory)	Tianjin	200
Do.		Yunnan Smelter (Chinalco Yunnan Copper Group Co. Ltd.)	Yunnan, Kunming	250
Do.		Hangzhou Fuchunjiang Smelting Co. Ltd.	Zhejiang, Fuchunjiang	100
Gallium	metric tons	Shandong Aluminum Plant	Shandong, Zibo	10
Gas, natural	billion cubic meters	China National Petroleum Corp.	Sichuan	10
Germanium	metric tons	Shaoguan Smelter (Shenzhen Nonfemet Co.)	Guangdong, Shaoquan	30
Do.	do.	Nanjing Germanium Co. Ltd.	Jiangsu, Nanjing	30
Do.	do.	Nei Mongol Xilingol Tongtai Germanium Refine Co. Ltd.	Nei Mongol, Xilinhot	20
Do.	do.	Shanghai Lontai Copper Co. Ltd.	Shanghai	10
Do.	do.	Lincang Xinyuan Germanium Co. Ltd.	Yunnan, Lincang	30
Do.	do.	Yunnan Chihong Zinc and Germanium Co. Ltd.	Yunnan, Qujing	10

See footnotes at end of table.

TABLE 2—Continued
CHINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies[1]	Location of main facilities[2]	Annual capacity[e]
Gold, refined	metric tons	China National Gold Corp.	Henan, Lingbao	10
Do.	do.	Zhongyan Gold Smelter (Zhongjin Gold Co. Ltd.)	Henan, Sanmenxia	30
Do.	do.	Jiangxi Copper Co. Ltd.	Jiangxi, Guixi	18
Do.	do.	Laizhou Gold Co.	Shandong, Laizhou	15
Do.	do.	Shandong Yanggu Xiangguang Co. Ltd.	Shandong, Yanggu	20
Do.	do.	Yantai Penghui Copper Industry Co. Ltd.	Shandong, Yantai	5
Do.	do.	Zhaoyuan Gold Co.	Shandong, Zhaoyuan	15
Do.	do.	Great Wall Gold Silver Refinery	Sichuan, Chengdu	100
Graphite		Jixi Aoyu Graphite Co. Ltd.	Heilongjiang, Jixi and Luo	60
Do.		Nei Mongol Xinghe Jingxin Graphite Co. Ltd.	Nei Mongol, Xinghe	10
Indium	metric tons	Laibin Smelter [Liuzhou Huaxi (China Tin) Group Co.]	Guangxi, Laibin	100
Do.	do.	Liuzhou Zinc Products Co.	Guangxi, Liuzhou	20
Do.	do.	Yuguang Gold-Lead Co. Ltd.	Henan, Jiyuan	10
Do.	do.	Zhuzhou Smelter	Hunan, Zhuzhou	60
Do.	do.	Huludao Nonferrous Metals Group Co.	Liaoning, Huludao	30
Do.	do.	Yunnan Mengzi Mining and Smelting Co. Ltd.	Yunnan, Honghe	50
Iron and steel:				
Iron ore		Ma'anshan Iron and Steel Co.	Anhui, Maanshan	10,000
Do.		Shoudu (Capital) Mining Co.	Beijing	20,000
Do.		Jiuquan Iron and Steel Co.	Gansu, Jiayuguan	4,000
Do.		Hainan Iron Mine	Hainan, Changjiang	4,600
Do.		Handan Xingtai Metallurgical Bureau	Hebei, Handan	3,800
Do.		Tangshan Iron and Steel Co.	Hebei, Tangshan	3,000
Do.		Wuhan Iron and Steel (Group) Co. (Wugang)	Hubei, Wuhan	5,100
Do.		Meishan Metallurgical Co.	Jiangsu, Nanjing	2,000
Do.		Banshigou Iron Mine Mining Co.	Jilin, Hunjiang	1,400
Do.		Anshan Mining Co.	Liaoning, Anshan	30,000
Do.		Benxi Iron and Steel Co.	Liaoning, Benxi	13,700
Do.		Baotou Iron and Steel and Rare Earth Co.	Nei Mongol, Baotou	10,000
Do.		Taiyuan Iron and Steel Co.	Shanxi, Taiyuan	4,000
Do.		Dabaoshan Mining Co.	Guangdong, Qujiang	1,670
Do.		Panzhihua Mining Co.	Sichuan, Panzhihua	13,000
Do.		Kunming Iron and Steel Co.	Yunnan, Kunming	1,400
Ferroalloys		Shoudu (Capital) Iron and Steel (Group) Co.	Beijing	35
Do.		Qingshan Holding Group Co. Ltd.	Fujian, Fu'an	300
Do.		Desheng Nickel Industry Co. Ltd.	Fujian, Luoyuanwan	920
Do.		Northwest Ferroalloy Co.	Gansu, Yongdeng	60
Do.		Zunyi Ferroalloy Co.	Guizhou, Zunhi	100
Do.		Zhejiang Huaguang Smelting Group	Jiangxi, Hengfeng	50
Do.		Jilin Ferroalloy Co.	Jilin, Jilin	250
Do.		Jinzhou Ferroalloy Co.	Liaoning, Jinzhou	90
Do.		Liaoyang Ferroalloy Co.	Liaoning, Liaoyang	70
Do.		Shanghai Iron and Steel Co. Ltd.	Shanghai	180
Do.		Emei Ferroalloy Co.	Sichuan, Emei	70
Do.		Hengshan Ferroalloy Co.	Zhejiang, Jiande	70
Crude steel		Ma'anshan Iron and Steel Co.	Anhui, Maanshan	10,000
Do.		Shoudu (Capital) Iron and Steel (Group) Co. (Shougang)	Beijing	4,000
Do.		Liuzhou Iron and Steel Group	Guangxi, Liuzhou	6,000
Do.		Handan Iron and Steel General Work (Handan)	Hebei, Handan	10,000
Do.		Shougang Qianan Iron and Steel Co. Ltd. (Shougang)	Hebei, Qianan	4,500
Do.		Tangshan Iron and Steel Co. (Taigang)	Hebei, Tangshan	12,000
Do.		Wuhan Iron and Steel (Group) Co. (Wugang)	Hubei, Wuhan	12,000

See footnotes at end of table.

TABLE 2—Continued
CHINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies[1]	Location of main facilities[2]	Annual capacity[e]
Iron and steel—Continued:			
Crude steel—Continued	Shagang Group Co. Ltd.	Jiangsu, Zhangjiagang	30,000
Do.	Anshan Iron and Steel (Group) Co. (Angang)	Liaoning, Anshan	16,000
Do.	Benxi Iron and Steel Co. (Bengang)	Liaoning, Benxi	6,000
Do.	Baotou Iron and Steel and Rare Earth Co. (Baogang Group)	Nei Mongol, Baotou	10,000
Do.	Baoshan Iron and Steel (Group) Corp. (Baosteel) [Baogang Group]	Shanghai	19,000
Do.	Shanghai Iron and Steel Co. Ltd.	do.	6,000
Do.	Shandong Jinan Iron and Steel Group Co.	Shandong, Jinan	10,000
Do.	Shandong Laiwu Iron and Steel Group Co.	Shandong, Laiwu	10,000
Do.	Taiyuan Iron and Steel Co. (Taigang)	Shanxi, Taiyuan	5,000
Do.	Panzhihua Iron and Steel (Group) Co. (Pangang)	Sichuan, Panzhihua	6,000
Do.	Xinjiang Biyi Iron and Steen Group (Baogang Group)	Xinjiang, Urumqi	6,000
Lead	Jiuhua Smelter (Tongling Nonferrous Metals Group Holding Co. Ltd.)	Anhui, Chizhou	80
Do.	Baiyin Nonferrous Metals Co. Ltd.	Gansu, Baiyin	80
Do.	Shaoguan Smelter (Shenzhen Nonfemet Co.)	Guangdong, Shaoquan	100
Do.	Laibin Smelter [Huaxi (China Tin) Group Co.]	Guangxi, Laibin	100
Do.	Hechi Nanfang Nonferrous Metals Smelting Co. Ltd.	Guangxi, Hechi	80
Do.	Anyang Smelter (Yubei Metal Co.)	Henan, Anyang	160
Do.	Jiyuan Wangyang Nonferrous Smelter	Henan, Jiaozuo	100
Do.	Jiyuan Smelter (Yuguang Gold-Lead Co. Ltd.)	Henan, Jiyuan	300
Do.	Henan Lingye Co. Ltd.	Henan, Lingbao	100
Do.	Hanjiang Smelter	Hubei, Luhekou	50
Do.	Shuikoushan Nonferrous Metals Co. Ltd.	Hunan, Hengyang	100
Do.	Zhuzhou Smelter (Zhuye Torch Metals Co. Ltd.)	Hunan, Zhuzhou	100
Do.	Xuzhou Chunxing Alloy Co. Ltd.	Jiangsu, Xuzhou	150
Do.	Jiangxi Jinde Lead Co. Ltd.	Jiangxi, Shangrao	80
Do.	Huludao Nonferrous Metals Group Co. Ltd.	Liaoning, Huludao	30
Do.	Kunming Smelter	Yunnan, Kunming	100
Do.	Yunnan Chihong Zinc and Germanium Co. Ltd.	Yunnan, Qujing	100
Lithium, $LiCO_3$	Baiyin Zabuye Lithium Co. Ltd. (Zabuye Lithium High-Tech Co. Ltd.)	Gansu, Baiyin	5
Do.	Sichuan Shehong Lithium Co. Ltd.	Sichuan, Shehong	2
Do.	Sichuan Tianqi Lithium Industry Co. Ltd. (Chengdu Tianqi Group Co. Ltd.)	Sichuan, Suining	7
Do.	Qinghai Yanhu Industry Group Co. Ltd.	Qinghai, Golmud	10
Do.	Xinjiang Lithium Co.	Xinjiang, Urumqi	5
Magnesium	Zunyi Titanium Co. Ltd.	Guizhou, Zunyi	24
Do.	Ningxia Huayuan Magnesium Group	Ningxia, Yinchuan	15
Do.	Huayu Interprises (Group) Ltd.	Shanxi, Jishan	35
Do.	Taiyuan Tongxiang Magnesium Metal Co. Ltd.	Shanxi, Taiyuan	45
Do.	Taiyuan Yiwei Magnesium Co. Ltd.	do.	21
Do.	Wenxi Biyun Magnesium Co. Ltd.	Shanxi, Wenxi	30
Do.	Wenxi Yinguang Magnesium Group	do.	40
Manganese, metal	Chongqing Tycoon Manganese Co. Ltd.	Chongqing	23
Do.	Guangxi Dameng Manganese Industry Co. Ltd.	Guangxi, Nanning	70
Molybdenum, concentrate	Luoyang Luanchuan Molybdenum Industry Group Co., Ltd.	Henan, Luanchuan	30
Do.	Jinduicheng Molybdenum Industry Group Co. Ltd.	Shaanxi, Huaxian	30

See footnotes at end of table.

TABLE 2—Continued

CHINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies[1]	Location of main facilities[2]	Annual capacity[e]
Nickel, refined	Jinchuan Nonferrous Metals Corp.	Gansu, Jinchuan	120
Do.	Guangxi Yulin Weinie Co. Ltd.	Guangxi, Bobai	18
Do.	Jiangxi Jiangli New Type Material Co. Ltd.	Jiangxi, Fenyi	10
Do.	Jilin Jien Nickel Industry Co. Ltd.	Jilin, Panshi	10
Do.	Inco New Nickel Materials (Dalian) Co. Ltd.	Liaoning, Dalian	32
Do.	Chengdu Electro-Metallurgy Factory	Sichuan, Chengdu	5
Do.	Xinjiang Fukang Smelter	Xinjiang, Fukang	15
Do.	Xinjiang Xinxin Mining Co. Ltd.	Xinjiang, Fuyun	7
Do.	Yuanjiang Nickel Industry Co. Ltd.	Yunnan, Yuxi	5
Petroleum, crude	Shengli Bureau	Hebei, Shengli	33,500
Do.	Daqing Bureau	Heilongjiang, Daqing	55,000
Do.	Liaohe Bureau	Liaoning, Liaohe	15,000
Do.	Bohai Offshore Oil Corp.	Bohai	4,000
Do.	Nanhai East Corp.	Nanhai	5,000
Potash	Qinghai Yanhu Industry Group Co. Ltd.	Qinghai, Charhan	2,000
Rare earths	Gansu Rare Earths Co.	Gansu, Baiyin	32
Do.	Jiangxi Rare Earths Co.	Jiangxi, Nanchang	1
Do.	Zhujiang Smelter	Guangdong, Guangzhou	5
Do.	Baotou Iron and Steel and Rare Earths Corp. (Baogang Group)	Nei Mongol, Baotou	55
Do.	Shanghai Yaolong Nonferrous Metals Co.	Shanghai	2
Salt	Shandong Haihua Group Co. Ltd.	Shandong, Weifang	1,400
Do.	Zigong Zhangjiaba Salt Chemical Plant	Sichuan, Zigong	250
Silver metric tons	Laibin Smelter [Huaxi (China Tin) Group Co.]	Guangxi, Laibin	80
Do. do.	Daye Nonferrous Metals Co.	Hubei, Daye	100
Do. do.	Jiyuan Smelter (Yuguang Gold-Lead Co. Ltd.)	Henan, Jiyuan	600
Do. do.	Jiangxi Copper Co. Ltd.	Jiangxi, Guixi	415
Do. do.	Huludao Nonferrous Metals Group Co. Ltd.	Liaoning, Huludao	80
Do. do.	Yantai Penghui Copper Industry Co. Ltd.	Shandong, Yantai	80
Do. do.	Great Wall Gold Silver Refinery	Sichuan, Chengdu	300
Do. do.	Yunnan Smelter (Yunnan Copper Group Co. Ltd.)	Yunnan, Kunming	450
Strontium, carbonate	Chongqing Chonglong Strontium Co. Ltd.	Chongqing	20
Do.	Chongqing Tongliang Redbutterfly Strontium Co.	do.	120
Do.	Hebei Xinji Chemical Group	Hebei, Xinji	130
Do.	Nanjing Jinyan Strontium Co. Ltd.	Jiangsu, Lishui	20
Talc	China National Nonmetallic Industry Corp.	Guangxi, Longshen	130
Do.	do.	Liaoning, Haicheng	50
Do.	do.	Shandong, Qixia	5
Tin, smelter	Laibin Smelter [Huaxi (China Tin) Group Co.]	Guangxi, Laibin	25
Do.	Pinggui Mining Bureau	Guangxi, Zhongshan	8
Do.	Nanshan Tin Co. Ltd.	Jiangxi, Ganzhou	10
Do.	Yunnan Tin Industry Co.	Yunnan, Gejiu	55
Titanium, sponge	Guizhou Southwest Titanium Co. Ltd.	Guizhou, Guiyang	3
Do.	Zunyi Titanium Co. Ltd.	Guizhou, Zunyi	14
Do.	Luoyang Sun Rui Wanji Titanium Industry Co. Ltd.	Henan, Xinan	10
Do.	Chaoyang Baisheng Zirconium Co. Ltd.	Liaoning, Chaoyang	8
Do.	Chaoyang Jintai Titanium Co. Ltd.	do.	3
Do.	Fushun Titanium Co. Ltd.	Liaoning, Fushun	5
Do.	Jinzhou Huashen Nonferrous Metals Plant	Liaoning, Jinzhou	4
Tungsten, concentrate	Ninghua Hangluoken Tungsten Mine (Amoi Tungsten Co. Ltd.)	Fujian, Ninghua	4
Do.	Shizhuyuan Nonferrous Metals Co.	Hunan, Chenzhou	5
Do.	Yaogangxian Tungsten Mine	Hunan, Yizhang	3
Do.	Jiangxi Tungsten and Rare Earth Co. Ltd.	Jiangxi, Gangzhou	15

See footnotes at end of table.

TABLE 2—Continued

CHINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies[1]	Location of main facilities[2]	Annual capacity[e]
Zinc	Northwest China Lead-Zinc Smelter (Baiyin Nonferrous Metals Co. Ltd.)	Gansu, Baiyin	150
Do.	Shaoguan Smelter (Shenzhen Nonfemet Co.)	Guangdong, Shaoquan	180
Do.	Hechi Nanfang Nonferrous Metal Smelting Co. Ltd.	Guangxi, Hechi	200
Do.	Liuzhou Nonferrous Metal Smelting Co. Ltd. (former Liuzhou Zinc Products Factory)	Guangxi, Liuzhou	100
Do.	Yugang Gold-Lead Co. Ltd.	Henan, Jiyuan	250
Do.	Shuikoushan Nonferrous Metals Co. Ltd.	Hunan, Hengyan	60
Do.	Zhuzhou Smelter (Zhuye Torch Metals Co. Ltd.)	Hunan, Zhuzhou	500
Do.	Huludao Zinc Smelting Co. (Huludao Nonferrous Metals Group. Co. Ltd.)	Liaoning, Huludao	390
Do.	Zijin Bayannur Co. Ltd.	Nei Mongol, Bayannar League	220
Do.	Dongling Zinc Industry Co. Ltd. (Dongling Group)	Shaanxi, Baoji	250
Do.	Laibin Smelter	Yunnan, Laibin	60
Do.	Yunnan Jinding Zinc Co. Ltd. (Sichuan Hongda Group)	Yunnan, Lanping	120
Do.	Yunnan Chihong Zinc and Germanium Co. Ltd.	Yunnan, Qujing	160

[e] Estimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto. NA Not available.

[1] Most companies are owned by either the central Government or a Provincial government.

[2] Listed by Province or Autonomous Region, followed by locality.

TABLE 3
CHINA: EXPORTS OF SELECTED MINERAL COMMODITIES IN 2008

Commodity	Quantity (metric tons)	Value (thousands)
METALS		
Aluminum:		
Alumina	44,142	$29,558
Metal and alloys:		
Unwrought	841,292	2,136,194
Semimanufactures	1,900,000	6,366,035
Antimony metal, unwrought	9,453	52,680
Barium sulfate	3,840,000	200,991
Copper, metal and alloys:		
Unwrought	102,724	854,036
Semimanufactures	517,522	4,157,241
Iron and steel:		
Pig iron and cast iron	250,000	127,921
Steel:		
Bars and rods	12,620,000	11,540,374
Shapes and sections	3,650,000	3,313,761
Sheets and plates	28,790,000	29,267,799
Tube and pipe	1,340,000	3,004,565
Scrap	204,217	94,796
Manganese, unwrought	240,547	852,925
Molybdenum, ores and concentrates	23,626	867,249
Rare-earth products	54,963	687,770
Tin, metal and alloys, unwrought	559	11,306
Tungsten, tungstates	5,421	115,602
Zinc:		
Metal and alloys, unwrought	71,320	147,442
Oxide and peroxide	32,779	61,743
INDUSTRIAL MINERALS		
Cement	26,040,000	1,098,795
Fluorspar	660,000	190,606
Granite	1,210,000	188,256
Graphite, natural	600,000	163,980
Magnesia, fused	2,270,000	335,326
Talc	690,000	123,469
MINERAL FUELS AND RELATED MATERIALS		
Coal	45,430,000	5,240,265
Coke, semicoke	12,130,000	5,807,369
Petroleum:		
Crude oil	4,160,000	2,979,552
Refinery products	17,030,000	13,665,164

Source: General Administration of Customs of the People's Republic of China, 2008, China monthly exports and imports, no. 12.

TABLE 4
CHINA: IMPORTS OF SELECTED MINERAL COMMODITIES IN 2008

(Metric tons unless otherwise specified)

Commodity		Quantity	Value (thousands)
METALS			
Aluminum:			
Alumina		4,590,000	$1,775,694
Metal and alloys, unwrought		260,102	564,138
Semimanufactures		618,620	3,188,836
Scrap		2,150,000	2,540,178
Chromium, chromite		6,480,000	2,714,382
Copper:			
Ore and concentrates		5,190,000	10,440,152
Anode		197,571	1,404,611
Metal and alloys, unwrought		1,702,039	11,660,119
Semimanufactures		934,950	7,567,250
Scrap		5,580,000	5,969,151
Iron and steel:			
Iron ore		443,560,000	60,531,628
Steel:			
Bars and rods		960,000	1,516,407
Scrap		3,590,000	2,467,387
Seamless pipe		1,060,000	4,144,345
Shapes and sections		330,000	370,277
Sheets and plates		12,730,000	16,011,819
Manganese ore		7,570,000	3,469,752
Nickel:			
Ore and concentrates		12,318,022	2,064,439
Metal		9,600	248,459
Titanium dioxide		250,651	526,263
INDUSTRIAL MINERALS			
Diamond	kilograms	3,388	3,025,786
Fertilizers:			
Compound fertilizers		640,000	402,556
Diammonium phosphate		100,000	126,104
Potassium chloride		5,140,000	2,831,054
Potassium sulfate		110,000	46,309
Urea		67	97
MINERAL FUELS AND RELATED MATERIALS			
Coal		40,400,000	3,509,106
Petroleum:			
Crude oil		178,880,000	129,334,996
Refinery products		38,850,000	30,044,320

Source: General Administration of Customs of the People's Republic of China, 2008, China monthly exports and imports, no. 12.

TABLE 5
CHINA: RESERVES OF MAJOR MINERAL COMMODITIES

(Thousand metric tons unless otherwise specified)

Commodity		Reserves
Antimony, Sb		950
Barite, ore	million metric tons	100
Bauxite	do.	750
Bentonite	do.	890
Chromite, ore		5,800
Coal	billion metric tons	330
Copper, Cu		29,000
Fluorite, mineral		34,000
Gas, natural	billion cubic meters	3,200
Gold, Au	metric tons	1,900
Graphite, mineral		55,000
Iron ore, ore	million metric tons	22,000
Kaolin, ore	do.	650
Lead, Pb		13,000
Magnesite, ore	million metric tons	1,900
Manganese, ore	do.	220
Mirabilite, Na_2SO_4	do.	10,000
Molybdenum, Mo		4,300
Nickel, Ni		3,000
Petroleum	million metric tons	2,800
Phosphorus, ore	do.	3,700
Potash, KCl		340,000
Rare earths, rare-earth oxide		18,000
Salt, NaCl	billion metric tons	190
Silver, Ag		43
Sulfur, natural, S		240
Talc, ore	million metric tons	120
Tin, Sn		1,500
Tungsten, WO_3		2,400
Vanadium, V_2O_5		13,000
Zinc, Zn		42,000

do. Ditto.

THE MINERAL INDUSTRY OF FIJI

By Lin Shi

Fiji's mining activities mainly involved the production of cement, gold, limestone, sand and gravel, and silver. The country also showed potential for offshore oil deposits. None of the minerals produced in Fiji in 2008 was of world significance (table 1).

According to the ANZ Pacific Quarterly, Fiji's real gross domestic product (GDP) growth rate for 2008 was 1.2%, and the inflation rate was 7.8%. The economic and political environment of Fiji was dominated by restricted consumer credit, uncertainty regarding the domestic political situation, the effects of the downturn in the global economy, and the modest activity in the local economy. Investment continued to slow down because the global financial crisis made acquiring credit more inconvenient and expensive for foreign investors, and some investors revised their proposed projects and delayed or canceled them. Nevertheless, Fiji's gold production was expected to increase in 2008 because of the country's mining tradition and financial need for the mineral export revenue (ANZ Pacific Quarterly, 2008, 2009). According to the Fiji Islands Bureau of Statistics' National Accounts Office, the output value of the mining and quarrying sector, which decreased by 97.9% in 2007, contributed about 0.01% of the GDP in 2007 (the latest year for which data were available) compared with about 0.5% of the GDP in 2006 and about 1% of the GDP in 2005 (Fiji Islands Bureau of Statistics, 2008d).

Production

Fiji produced 638 kilograms (kg) of gold and 265 kg of silver in 2008, which were significant increases compared with output in 2007. The increase in production was owing to the reopening of the Vatukoula Mine in 2008. The country's annual production of cement was 143 thousand metric tons, which was a decrease of 1.4% from the 145 thousand metric tons produced in 2007 (table 1; Fiji Islands Bureau of Statistics, 2008c).

According to the Fiji Islands Bureau of Statistics, production in the mining and quarrying sector increased gradually during the year; the sector's quarterly industrial production index (IPI) for all four quarters of 2008 were 10.6, 18.0, 36.6, and 48.0, respectively. The IPI is based on the output of representative commodities from each industrial sector and does not reflect changes in prices. A comparison of Fiji's annual IPI for 2007 and 2008 (using the same statistical scale) indicates that, in 2008, the country's gold production increased by 2,278% and concrete production increased by 10%; the output of the quarrying sector was unchanged. In addition, gas production decreased by 26%; fertilizer production, by 15%; and cement production, by 1% (Fiji Islands Bureau of Statistics, 2008b).

Structure of the Mineral Industry

Fiji had been a major regional gold producer for more than 80 years, and mining was an integral part of Fiji's economy. Gold exports were the country's second most valuable export. The country's mineral industry consisted of one British-owned gold mining company, one locally operated cement company, and several locally operated small industrial minerals quarries (company names and their production capacities were not available) that produced such construction materials as limestone, sand and gravel, and other construction aggregates. The country hosts several major porphyry copper-gold and epithermal gold mineralized areas (Register of Indo-Pacific Mining, 2009, p. 24).

Government Policies and Programs

The Ministry of Lands, Mineral Resources, and Environment (MLMRE) is the main Government agency that implements the country's mineral development policies under the Mining Act of 1978, which was revised in 1985. Under the MLMRE, the Mineral Resources Department (MRD) develops mining policies and provides geologic information to assist mining sector investors. The MRD also facilitates the exploration and development of mineral and petroleum resources in the country (Mineral Resources Department, 2007).

Mineral Trade

Fiji was a net importer in 2008. The value of mineral imports increased by 28% to $701 million from $547 million in 2007, and the value of mineral exports increased by 4% to $4,972,240 from $4,800,320 in 2007. The main trading partner countries for imports were Singapore (35%), Australia (20%), New Zealand (13%), the United States (7%), China (4%), and India (3%). The main trading partner countries for exports were the United Kingdom (15%), Australia (12%), New Zealand (6%), the United States (5.3%), Tonga (5.2%), and Japan (4%) (Fiji Islands Bureau of Statistics, 2008e).

Fijian imports of mineral fuels included automobile distillate fuels, aviation fuel, industrial distillate fuels, and motor spirits (gasoline). Mineral fuel imports were valued at $684.4 million and accounted for 33.9% of the total value of imports in 2008 compared with $536.6 million, or 33.2% of the total import value in 2007, which was an increase of $147.8 million, or 27.5%. Imports of industrial distillate fuel were valued at $288.7 million and accounted for 42.2% of the value of imported mineral fuels. Imports of aviation turbine fuel were valued at $245.8 million and accounted for 35.9% of the value of imported mineral fuels. These increases were driven mainly by the growing tourist industry and increases in the traditional processing of sugar, and the manufacturing of textiles, garments, and fish.

Gold was Fiji's major export mineral commodity. Gold exports were valued at $150 million and accounted for about 1.8% for the country's exports in 2008 compared with only $1.6 million and about 0.3% of the country's exports in 2007 (Fiji Islands Bureau of Statistics, 2008a).

Commodity Review

Metals

Gold and Silver.—In 2008, most of Fiji's gold and silver production was exported. The Vatukoula gold mine, which was closed in December 2006, was reopened in October 2007 by Westech Gold Pty Ltd., which was renamed Vatukoula Gold Mines plc (VGM) on October 1, 2008, to reflect the local significance of the gold project to the Fijian economy. VGM was a 100%-owned subsidiary of River Diamonds PLC of the United Kingdom, which therefore held 100% interest in the Vatukoula gold mine. The mine is located 60 kilometers northeast of Nadi in Viti Levu Province and was the country's primary producing gold and silver mine. The mine contains about 23,800 kilograms (kg) of gold reserves, and its gold resources totaled 16.84 million metric tons at an average grade of 9.49 grams per metric ton (g/t) gold, or about 142,000 kg of gold (Vatukoula Gold Mines plc, 2008a).

On May 18, 2008, the company had its first operational gold pour from the Vatukoula gold mine since the mine was placed on care-and-maintenance status in December 2006. The gold pour was from concentrates produced through the mill's recommissioned flotation, roaster, and calcine circuits. The pour totaled about 22 kg of gold ore (including 18.17 kg of fine gold and 3.43 kg of fine silver), which was in line with production targets. The pour represented the final step in the recommissioning of operations at the mine. By the end of 2008, VGM had three operating shafts and a decline, plus more than 450 kg of underground drives. VGM was ramping up to increase production to 3,100 kilograms per year of gold. Operations within the mine had reached a steady-state condition; ore from both the underground and open pit operations was being supplied to the mill on a daily basis. The mine employed approximately 750 people, and VGM also recruited an operational management team to complement the existing management in Fiji. The company was looking forward to continuing with gold operations at the mine (Vatukoula Gold Mines plc, 2008b, c).

Newcrest Mining Ltd. engaged in an advanced exploration project in the Namosi region. Its work was focused on two key areas. The first area of focus involved exploration of the Waisoi deposit, which included a study to test possible depth extensions of the previously identified mineralization. The study was to evaluate potential open pit and underground mining exploitation options, as well as the infrastructure, permitting, and services requirements. For the second area of focus, exploration was conducted on the remaining 723.5-square-kilometer tenement, with an emphasis on the more than 15 significant copper and gold prospects already identified during previous reconnaissance exploration. The Government renewed the special prospecting license for the Namosi project area in 2007 until March 2010 (Newcrest Mining Ltd., 2009).

Industrial Minerals

Cement.—Crushed stone, dimension stone, limestone, and sand and gravel were produced and consumed domestically by the construction industry. All limestone produced was consumed as raw material by Fiji's single cement producer, Fiji Industries Ltd. (FIL).

Based in Lami, which is located just outside the capital Suva, FIL was the only supplier of cement and related products in Fiji and was the preferred supplier to the Pacific island countries. FIL's major products were general purpose portland cement and general purpose blended cement. In 2008, FIL was involved in several projects, including supplying 14,000 metric tons (t) of cement to two projects of the Fiji Electricity Authority: one project involved the construction of a new hydroelectric dam in Nadarivatu, and the other was for the improvement of the country's main hydroelectric dam at Monasavu. FIL also provided 12,000 t of cement to the Natadola Marine Resort project and 9,000 t of cement to the Laucala Island resort project (Fiji Industries Ltd., 2008).

Outlook

According to Fiji Islands Bureau of Statistics, 2009 is expected to be a difficult year for the economy of Fiji. GDP growth is likely to fall well below the official forecast of 2.4%. In line with the global economic development, all Fiji's major trading partners are expected to experience economic difficulties in 2009. The country expected a decrease in imports as well as a continuing decrease in exports owing to falling global demand and supply-side constraints. The activity of the Fiji mining sector is likely to remain at least at the 2007 production level, and to begin to show modest recovery owing to the planned increase in gold production from the Vatukoula gold mine, and development of the copper-gold mine in the Namosi region (Fiji Government Online, 2009; Fiji Islands Bureau of Statistics, 2009f).

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TABLE 1
FIJI: PRODUCTION OF MINERAL COMMODITIES [1]

Commodity[2]		2004	2005	2006	2007	2008
Cement, hydraulic[e]	metric tons	120,000	143,000	143,000	145,000	143,000
Gold, mine output, Au content	kilograms	3,731	2,793	1,430 [e]	16 [e]	638
Limestone[e]	metric tons	180,000	215,000	215,000	220,000	215,000
Sand and gravel[e]	cubic meters	280,000	330,000	300,000	310,000	300,000
Silver, mine output, Ag content	kilograms	1,901	1,418	750 [e]	3 [e]	265

[e] Estimated; estimated data are rounded to no more than three significant digits.

[1] Table includes data available through June 22, 2009.

[2] In addition to the commodities listed, bauxite, coral sand, crushed and dimension stone, marble, and other construction materials are produced, but data are insufficient to make reliable estimates of output.

TABLE 2
FIJI: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Cement		Fiji Industries Ltd. (FIL) (an affiliate company of Holcim Group)	Lami, Suva, Fiji	145
Gold	kilograms	Vatukoula Gold Mines plc (River Diamonds PLC, 100%)	Vatukoula, on the island of Viti Levu	1,700
Silver	do.	do.	do.	340

[e] Estimated. do. Ditto.

THE MINERAL INDUSTRY OF INDIA

By Chin S. Kuo

India has globally significant mineral resources; its deposits of coal, bauxite, and iron ore account for 10%, 4%, and 3% of the world's total resources, respectively. In terms of the relative size of its mineral resources, India's barite resource was the second largest in the world after China; iron ore, the third largest; coal [which totaled 250 billion metric tons (Gt)], the fourth largest; and bauxite (2.3 Gt), the sixth largest. The country's resources of chromium, limestone, and manganese were also among the 10 largest in the world. Of these resources, 1.4 Gt of bauxite and 62 Gt of coal are located in the State of Orissa, which also hosts resources of chromium, cobalt, nickel, and titaniferous magnetite (Ministry of Mines, 2009, p. 21).

In terms of production, India was among the leading producers in the world of mica (first); barite, chromium, and talc (second); bauxite and coal (third); iron ore and kyanite (fourth); manganese ore and steel (fifth); zinc (seventh); and aluminum (eighth) (Ministry of Mines, 2009, p. 11).

Minerals in the National Economy

India's mineral industry contributed 1.9% of the gross domestic product (GDP) and was an important sector of the economy in fiscal year 2008-09. Mineral production in terms of tonnage increased by 2.34%, and total output in terms of value increased by 7.1%. The value of mineral fuels accounted for 62% of total output; metals, 25%; and industrial minerals, 12%. The value of mineral exports increased by 17% and that of mineral imports increased by 15% compared with those of fiscal year 2007-08 (Ministry of Mines, 2009, p. 8-9, 109-111).

Government Policies and Programs

In March, the Government approved a new mining policy designed to simplify the country's mining regulations. The Parliament would begin consideration of the proposed legislation in August. The main regulatory changes would be accelerating the mining lease application process to between 6 and 12 months from more than a year, making mining lease approval automatic for companies that discover the mineral resources, and granting companies the rights to deal with prospecting data (Industrial Minerals, 2008i).

Once a new mining policy is in place, the Government expected to increase foreign direct investment (FDI) in mining to $125 billion in 5 years. The Government also decided to allow 100% FDI in the Kerala mineral sand project. The new mining policy would aim to liberalize the market by smoothing the transition between prospecting to mining and unbundling the buying and selling of exploration data. The policy also would revise the way that royalty rates are determined for certain industrial minerals; instead of being assessed on a tonnage basis, royalty rates for ball clay, graphite, kaolin, quartz, and silica sand are to be based on the assessed value. For dolomite, limestone, and slate, the royalty rates would continued to be based on the number of units produced (Industrial Minerals, 2008d).

The Government planned to replace the export duty on iron ore with a uniform 10% to 15% tax on the free-on-board value of exports. In 2007, India introduced a $7.56 per metric ton duty on iron ore with more than 62% iron and a $1.26 per metric ton duty on iron ore with up to 62% iron. India exported 93 million metric tons (Mt) of iron ore in fiscal year 2006-07, of which 75% went to China (Metal Bulletin, 2008a).

The Government exempted local fertilizer manufacturers from the 5% custom tax on imports of phosphate rock, effective June 10, 2008. The Indian fertilizer market experienced rapid growth, and the prices of such raw materials as phosphate rock and potash increased substantially. Fertilizers and Chemicals Travancore Ltd. was to develop a gypsum-based fertilizer to meet the demand of the growing market for fertilizers (Industrial Minerals, 2008c).

The Finance Bill 2008 proposed to withdraw the tax holiday for oil and gas companies engaged in refining activities if such activities were to commence on or after April 1, 2009. Under the Petroleum Tax Guide 1999, oil and gas companies engaged in mineral fuel exploration and production activities are entitled to claim 100% tax holiday for a period of 7 years. The guide defines "mineral fuels" as fuels obtained from below the surface in the form of hydrocarbons—the heavier form is crude oil and the lighter form is natural gas (Alexander's Gas & Oil Connections, 2008b).

Production

In 2008, production of mined lead and zinc rose by 12.7% and 7.3%, whereas that of refined lead and zinc increased by 11.5% and 25.1%, respectively, compared with the outputs of 2007. The increases were attributed to expanded mining operations and capacity additions at the smelters. The country mined 17.5% more chromium and produced 12.5% less cobalt metal. Gold production declined by 10%, and silver output increased by 16.7%. India produced nearly 55 Mt of crude steel and 20 Mt of direct-reduced iron in 2008, which was an increase of 4% and 11.6%, respectively. Crude steel capacity utilization was 89%. Output of natural gas increased by 2%, and that of crude oil decreased slightly (table 1).

Structure of the Mineral Industry

The Ministry of Mines is responsible for the survey and exploration of all minerals except natural gas, petroleum, and uranium; for the mining and metallurgy of nonferrous metals; and for administration of the Mines and Minerals Act of 1957. Four public-sector companies are currently under the Ministry and the other two have been disinvested and management control transferred to strategic partners; the Ministry, however, continues to hold minority interest in these two companies. The mining industry was characterized by a large number of small operational mines, which totaled 2,950 in 2008. Public-sector companies continued to play a dominant role in mineral production; they controlled the mining and processing and were the main producers of aluminum, copper, and gold. Small mines were owned mostly by private-sector companies that produced cement and manganese ore.

Mineral Exploration Corp. Ltd. is responsible for the country's mineral exploration. The Ministry of Coal has the responsibility for determining the policies and strategies for the exploration for and development of coal and lignite reserves. Coal India Ltd., which is under the Ministry, has nine coal-producing subsidiaries, including Bharat Coking Coal Ltd. for coking coal and Neyveli Lignite Corp. Ltd. for lignite; it also owned 50% of Singareni Collieries Co. Ltd. Total employment in the mineral industry in 2008 was about 510,000 people (table 2).

Mineral Trade

India continued to be largely self-sufficient in mineral commodities, which were used as primary raw materials in various industries. India exported, in descending order of value, diamond (mostly cut), iron ore, granite, zinc ore and concentrate, chromium, bauxite, and alumina in fiscal year 2007-08. The country imported, in descending order of value, crude petroleum, diamond (uncut), and other commodities, including coal, coke, copper ores and concentrates, natural gas, phosphate rock, and sulfur (Ministry of Mines, 2009, p. 38-39). India exported 3.8 Mt of finished steel products and imported 5.8 Mt.

Commodity Review

Metals

Aluminum.—Sterlite Industries (India) Ltd.'s 3-million-metric-ton-per-year (Mt/yr) bauxite mining project at Lanjigarh in the State of Orissa was approved by India's Supreme Court despite the protests of farmers and indigenous communities. Mine life was expected to be 18 years. Bauxite would be used for the company's new $800 million 1.4-Mt/yr alumina refinery, which would also be located at Lanjigarh. The Court asked the company to invest at least $2.5 million per year in the region to help local tribes (Kosich, 2008).

National Aluminium Co. Ltd. planned a joint-venture project to expand its existing specialty alumina operations, which currently produced 26,400 metric tons per year (t/yr) (comprising 19,400 t/yr of specialty alumina and 7,000 t/yr of specialty alumina hydrate) for the domestic refractory and ceramics market. The project would increase production capacity to 100,000 t/yr for the overseas market. The Indian market for specialty alumina was 40,000 to 50,000 t/yr. The raw material for specialty alumina was sourced from the company's bauxite mines in the State of Orissa, which produced 4.8 Mt/yr of bauxite in 2008; plans were in place to increase the production capacity to 6.3 Mt/yr by 2009. The company also planned to upgrade the production capacity of its alumina refinery to 2.1 Mt/yr at about the same time (Industrial Minerals, 2008h).

Vedanta Resources plc planned to invest $9.8 billion to increase its aluminum smelting capacity to 2.6 Mt/yr by 2012 from the current 1 Mt/yr. Upon completion, Vedanta Resources would be Asia's leading aluminum producer. The existing capacity included the company's $5.65 billion Jharsuguda II project in the State of Orissa, which comprised a 1.25-Mt/yr aluminum smelter and a 1,980-megawatt (MW) captive thermal powerplant, and the $2 billion Korba III project, which comprised a 325,000-t/yr aluminum smelter and a 1,200-MW captive thermal powerplant in the State of Chhattisgarh. To achieve the targeted capacity, Vedanta Resources would increase its alumina production capacity at Lanjigarh to 5 Mt/yr from 1.4 Mt/yr with an investment of $2.15 billion; debottleneck the existing capacity, which would add 600,000 t/yr of capacity; and build three new alumina production plants with a capacity of 1 Mt/yr each (Vedanta Resources plc, 2008).

Hindalco Industries Ltd. acquired Novelis Ltd. (a subsidiary of Alcan Inc. of Canada), which owned a technology to develop aluminum alloy. Hindalco planned to use the value-added aluminum alloy to replace steel in the automobile industry. Although the aluminum alloy was expected to make a car 40% more expensive than a car made with steel, the alloy was lighter but would provide as much strength and shaping capability as steel (Metalworld News Digest, 2008).

Chromium.—CRONIMET Mining GmbH of Germany acquired a 70.5% interest in GMR Ferro Alloys and Industries Ltd., which would become CRONIMET Ferro Alloys (India) Ltd. CRONIMET Ferro Alloys was a producer of ferrochromium; it had a melting plant that included two furnaces with capacities of 6 megavoltamperes (MVA) and 9 MVA, respectively. The plant employed 230 people, produced 27,500 t/yr of ferrochromium, and exported about 75% of its output to China, Europe, Japan, and the Republic of Korea (CRONIMET Group, 2008).

Copper.—Pebble Creek Mining Ltd. of Canada continued exploration of its Askot project in the State of Uttarakhand, which was a massive sulfide deposit of copper and zinc that contains significant amounts of gold, lead, and silver. The company received Government approval of its mining lease application in 2008. The mine plan and environmental and forest clearance applications still had to be approved by Government agencies. Subsequently, the State government of Uttarakhand granted the company a mining lease that covered an area of 386 hectares (ha). In 2007, the company drilled 14 holes for a total of 3,505 meters (m) (Pebble Creek Mining Ltd., 2008).

India Resources Ltd. of Australia's Surda project, which was located in the Indian Copper Complex in the State of Jharkhand supplied copper concentrate to the Moubhandar smelter; the smelter was owned and operated by Hindustan Copper Ltd. (HCL) and had a production capacity of 20,000 t/yr of copper cathode. The initial supply of copper concentrate was targeted to be 4,500 metric tons (t) at a grade of 23% copper. The remaining copper concentrate would be imported by HCL or sourced from its Malanjkhand Mine in the State of Madhya Pradesh (Asia Miner, The, 2008b).

Gold.—The Jagpura gold prospect in the State of Rajasthan was 70% owned by Indo Gold Ltd. (IGL) of Australia and 30% owned by Metals Mining India Pvt Ltd. The operator was Indo

Gold Mines Pvt Ltd., in which IGL had a 70% interest. The area covered 2,013 square kilometers (km^2) and contained gold and base-metal prospects. Drillings were done at the Mahi and the Panch Mahuri zones of the Bhukia prospect, and the estimated resource was 54,000 kilograms of gold to a depth of 150 m. The mineralization at Bhukia was recognized as a potentially large, low-grade gold deposit (Indo Gold Ltd., 2008).

Iron and Steel.—Kudremukh Iron Ore Co. Ltd. restarted its pellet plant in 2007 and produced and exported 2 Mt of pellet. In 2008, it produced and exported 3.2 Mt from its installed production capacity of 3.5 Mt/yr. The company had iron ore mines in Kudremukh on the Western Ghats and a pelletization plant in Mangalore. The iron ore was transported through pipelines to the plant, and the pellets were exported to China, Iran, Japan, and Taiwan (Metal Bulletin, 2008d).

Outotec Oyj of Finland reached an agreement with Tata Steel for the delivery of an iron ore pelletizing plant to be built at Tata Steel's steel works in Jamshedpur. The contract included basic and detailed engineering, supply of critical and proprietary equipment, and technical assistance services. Outotec's local partner in the project was Larsen & Toubro Ltd. When completed in 2011, the pelletizing plant would be the largest in India with a 768-square-meter grate area. Outotec had previously delivered four sinter plants to Tata Steel's Jamshedpur works (Outotec Oyj Stock Exchange, 2008).

Metso Minerals India Pvt. Ltd. would supply an iron ore beneficiation plant to Ispat Industries Ltd.'s Hospet-Bellary Mine in the State of Karnataka. The order included a scrubber, a spiral classifier, a high-gradient magnetic separator, a vertical plate pressure filter, lamella thickeners, and pumps. The plant would treat 250 metric tons per hour (t/hr) of iron ore fines (Metso Corp., 2008). The Hospet-Bellary region is rich in iron ore; a large portion of the region's output is exported, and illegal mining was common. The Karnataka State police seized 200,000 t of iron ore worth $5.8 million from illegal mining and smuggling (Metal Bulletin, 2008b).

Output of iron ore from three mines at the Bailadila mining complex in the State of Chhattisgarh, which was run by National Mineral Development Corp. Ltd. (NMDC), stopped temporarily after rebels blew up power transmission towers in June. The three mines produced a total of 23 Mt/yr of iron ore in 2008. NMDC was a leading producer and supplier of iron ore to domestic steelmakers, such as Essar Steel Co. Ltd., Ispat Industries, and Rashtriya Ispat Nigam Ltd., and Japanese steel producers, such as JFE Steel Corp. and Nippon Steel Corp. (Mukherjee, 2008).

The Supreme Court of India approved a proposal by Pohang Iron and Steel Co. Ltd. (POSCO) of the Republic of Korea to use 1,210 ha of forest land for iron ore mining and to build a $12 billion steel plant at Jagatsinghpura in the State of Orissa. The villagers passed a resolution declaring its forest a protected community forest under the Forest Rights Law, which prohibits any entity to displace people from forest land until their rights have been settled (Kosich, 2008).

ArcelorMittal of Luxembourg planned to build a 6-Mt/yr integrated steel plant in the State of Chhattisgarh and to mine iron ore resources in the State. The cost for the new plant was estimated to be $4.1 billion. The State government allocated 65 Mt of iron ore for the mining project, which was not sufficient for the steel plant. Talks with the State government regarding an assured supply of iron ore were ongoing (Asia Miner, The, 2008a).

MSP Steel and Power Ltd. planned to expand the output of its steel plant at Raipur in the State of Chhattisgarh to 1 Mt/yr from 750,000 t/yr. The company had plans for further expansion at the site. MSP Steel also produced 750,000 t/yr of direct-reduced iron, 170,000 t/yr of pig iron, and 27,000 t/yr of ferroalloys and had a 36-MW captive powerplant. The company's coal projects in the States of Chhattisgarh and Maharashtra would be commissioned in 2010 and 2011, respectively (Metal Bulletin, 2008c).

Lead and Zinc.—Hindustan Zinc Ltd. (HZL) reported that ongoing exploration yielded an increase of 28.7 Mt in reserves and resources containing 4 Mt of zinc-lead metal. Total resources as of March 2008 were 232.3 Mt containing 27.5 Mt of zinc-lead metal. The company's exploration activities were in the Sindesar Khurd and the Rampura Agucha Mines. Ore production would be expanded to 6 Mt/yr from 5 Mt/yr at Rampura Agucha by 2010 and to 1.5 Mt/yr from 0.3 Mt/yr at Sindesar Khurd by 2012 (London Stock Exchange Group, 2008, p. 3).

HZL began production of zinc metal from its Phase II capacity expansion of 170,000 t/yr at the company's Chanderiya lead/zinc smelter in the State of Rajasthan. The total zinc capacity of the company would be 670,000 t/yr after a series of expansions. The company's two brownfield smelter projects at Rajpura Dariba in Rajasthan would increase the production capacities of zinc and lead by 210,000 t/yr and 100,000 t/yr, respectively. A captive thermal powerplant with a capacity of 160 MW would be set up at Rajpure Dariba by 2010 (London Stock Exchange Group, 2008, p. 1).

Rare Earths.—State-owned Indian Rare Earths Ltd. (IREL) planned to restart rare-earth production from its mineral sand operations. Rare-earth production at its plant at Aluva in the State of Kerala ceased in 2004 owing to strong competition from China. This plant would process 12,000 t/yr of monazite containing 7,000 t of rare-earth oxide in April 2010. The company engaged in chemical processing of monazite to yield thorium compounds, rare-earth chlorides, and tri-sodium phosphate. The company also was setting up a monazite processing plant in the State of Orissa where its mines and minerals separation plants were located (Industrial Minerals, 2008f).

Titanium.—Trimex Group was granted permission to begin production at its 200,000-t/yr-capacity ilmenite plant in the State of Andhra Pradesh; the facility was to be operated by its subsidiary Trimex Sands Pvt. Ltd. State-owned IREL produced 250,000 t/yr of ilmenite on average, and had plans to increase its production capacity to 750,000 t/yr. In addition to ilmenite, the Trimex plant would also produce 80,000 t/yr of sillimanite, 80,000 t/yr of garnet, 6,000 t/yr of rutile, and 6,000 t/yr of zircon. The deposit, which spans an area of 7.2 km^2 in the Srikumam District, contained 5.5 Mt of ilmenite reserves. Walchandnagar Industries Ltd. would be responsible for the plant's engineering procurement and construction. Downer EDI Mining-Mineral Technologies of Australia would supply the processing equipment (Industrial Minerals, 2008k).

IREL also mined and separated heavy minerals from beach sand, such as garnet, ilmenite, monazite, rutile, sillimanite, and zircon. Its minerals division had production plants at Chavara, Manavalakurichi, and OSCOM. At Chavara, the unit used a dredge and wet concentrator to exploit the inland deposits to generate sand feed containing 85% heavy minerals. The sand feed was subjected to final concentration carried out by being fed through a host of spirals to enrich to the concentrate 97% to 98% heavy minerals. Separation of minerals was by electrical and magnetic methods as well as by specific gravity (Indian Rare Earths Ltd., 2008).

The Government's decision to allow 100% FDI in the mineral sands industry of Kerala State received strong opposition from the State government and another party. The States of Kerala and Orissa have significant resources and production of mineral sands. Kerala contained 39% of India's mineral sand resources and IREL expanded its mining operations to 500,000 t/yr from 250,000 t/yr of ilmenite. The opposition group stressed that mining would upset the ecology of the areas and that the vital minerals would be exported (Industrial Minerals, 2008g).

Production at a $400 million joint-venture titanium dioxide pigment plant at Chatrapur in the State of Orissa was expected to begin in March 2008. The joint venture was between Saraf Agencies Pvt. Ltd. and Russia's Bank of Development and Foreign Economic Affairs and JSC Technochim Holdings. The key raw material would be supplied by IREL and Russia would provide the processing technology. The Government would invest $125 million, and Saraf Agencies would invest $36.4 million. India's other titanium dioxide pigment producers were Kerala Minerals and Metals Ltd., Kilburn Minerals Ltd., and Travancore. Balamurugan Chemicals Pvt. Ltd. planned to establish a new $20 million 15,000-t/yr titanium dioxide pigment plant at Tuticorin in the State of Tamil Nadu and to produce iron oxide pigment as secondary product (Industrial Minerals, 2008e).

Industrial Minerals

Cement.—With a cement production capacity of 185 Mt/yr in 2008, India planned to add 150 Mt/yr of capacity in the next 5 years, reaching 335 Mt/yr in 2013. Sagar Cements Ltd. planned to set up a 5-Mt/yr cement plant in the State of Karnataka. Cimentos de Portugal (Cimpor) acquired a 20% interest in Shree Digvijay Cement Co. Ltd. in the State of Gujarat, raising its stake to 73.6%. Shree Digvijay had a production capacity of 1.07 Mt/yr (International Cement Review, 2008b).

HeidelbergCement AG of Germany decided to merge Mysore Cements Ltd., Indorama Industries Ltd., and its 100% subsidiary HeidelbergCement India into a new entity. After the merger, HeidelbergCement would own 69% of the merged company. HeidelbergCement acquired a 54% stake in Mysore Cements in 2006. The company also acquired a 50% stake in Indorama in 2006 and the remaining 50% in 2008 (International Cement Review, 2008a).

Clay and Shale.—India has an abundance of kaolin deposits; deposits of high-quality grades occur in the State of Kerala where it has established a hub of kaolin production. English Indian Clays Ltd., which was the leading producer in Southeast Asia, had a total production capacity of 210,000 t/yr of kaolin (180,000 t/yr of hydrous and 30,000 t/yr of calcined). The company was in the process of doubling its calcined kaolin output to 60,000 t/yr at its operation near Trivandrum in the State of Kerala; the project was scheduled to be completed by August 2008. Ashapura Minechem planned to establish a new 200,000-t/yr-capacity kaolin plant in the State of Kerala; the plant was also scheduled for completion in August 2008. The plant would produce 50,000 t/yr each of air floated, lump, hydrous, and hydrous calcined grade. The kaolin feedstock would be supplied from Ashapura's own 300,000-t/yr Mullasseri Mine and other local deposits. The company was looking for additional untapped kaolin deposits, including a 600,000-t deposit at Sasthavattam, which was located 10 to 14 kilometers (km) from the plant (Industrial Minerals, 2008a).

Diamond.—Rio Tinto plc of the United Kingdom filed a mining lease application for its Bunder diamond project in the State of Madhya Pradesh. The exploration target for diamond mineralization at the project was between 40 and 70 Mt at a grade that varied between 0.3 and 0.7 carat per metric ton. The grades were at least three times greater than the grade of the closed Panna Mine, which was India's only other hard-rock diamond mine. Rio Tinto had spent more than $25 million during the past 6 years on diamond exploration and evaluation in India and planned to spend an additional $30 million to support continued evaluation of the deposit. The original discovery was made in 2002 and a prospecting license was executed in September 2006. An order of magnitude study was begun to evaluate the economic viability of the eight diamondiferous lamproites and was expected to have results in September 2008. Environmental approval for a 10-t/hr dense-media separation plant was expected from the local government (Mining Engineering, 2008).

India ceased all rough diamond imports beginning on November 25 owing to the worldwide economic crisis. The gemstone industry laid off 50,000 workers, or 4% of the workforce. Gem sales fell in October and India exported 35% of its diamond goods to the United States through the transshipment center of Mumbai. The country polished the majority of all rough diamond in the world in terms of both value and volume (Antwerp Facets News Service, 2008).

Phosphate Rock.—To ensure that the demand for phosphate rock for domestic fertilizer producers was met, the Government secured agreements with Legend International Holdings Inc. of Australia and Office Chenifien des Phosphates (OCP) of Morocco. Indian Farmers Fertilizers Cooperative Ltd. and Legend reached a long-term agreement for Legend to supply a minimum of 3 Mt/yr of concentrated phosphate rock to India from its Lady Annie project in Queensland within 2 to 3 years. The cooperative operated five fertilizer plants with a combined capacity of 4.3 Mt/yr of phosphorus fertilizer and 4.2 Mt/yr of nitrogen fertilizer. The Indian Ministry of Chemicals, Fertilizer and Steel and OCP discussed investment by Indian firms to develop a joint-venture phosphoric acid project in Morocco. Zuari Industries Ltd. already had a joint-venture project with OCP to produce phosphoric acid. India imported 1.1 Mt/yr of phosphate rock from Morocco, which represented 22% of total imports (Industrial Minerals, 2008b).

Soda Ash.—India's soda ash industry has been expanding domestic capacities and securing overseas sources. Glass and detergents were the main markets, each accounting for 40% of the country's output of soda ash. Nirma Ltd. (1 Mt/yr), Tata Chemicals Ltd. (TCL) (864,000 t/yr), and Gujarat Heavy Chemicals Ltd. (GHCL) (650,000 t/yr) were the leading producers. TCL planned to expand its production capacity to 1.2 Mt/yr by 2010 at its plant at Mithapur in the State of Gujarat with an investment of $140 million, and GHCL planned to add 250,000 t/yr to its current capacity at Sutrapada, Gujarat. In 2008, Nirma acquired Searles Valley Minerals Inc. of the United States and TCL made a bid for General Chemical Industry Products Inc., also of the United States, which owned 75% of General Chemical Soda Ash Partners. Owens-Illinois Inc. owned the remaining 25%. GHCL also aimed to acquire a company in China (Industrial Minerals, 2008j).

Talc.—Golcha Group produced talc from its Bhilwara and Dausa Mines in the State of Rajasthan, which had combined reserves of 25 Mt. The Group planned to increase its talc production by 100,000 t/yr in 2009 from the current 300,000 t/yr. Golcha Associated Group had a production capacity of 160,000 t/yr. Jai Group, which had a talc production capacity of 100,000 t/yr, planned to increase its capacity to 200,000 t/yr in the next 3 years. The company's Bharkundi I talc mine is located at Parsola, Rajasthan. In addition, the company had four smaller talc mines with capacities ranging from 5,000 t/yr to 15,000 t/yr (Industrial Minerals, 2008b).

Mineral Fuels and Related Materials

Coal.—Western Coalfields Ltd., which was a subsidiary of Coal India Ltd., planned to open 34 coal projects with a combined production capacity of 35.7 Mt/yr at a cost of $818 million during fiscal year 2011-12. Of the 34 projects (24 open cast and 10 underground), 4 had been approved, 12 had been formulated, and the remaining 18 had yet to be formulated. Currently, there were 26 ongoing projects with a combined capacity of 18 Mt/yr at a cost of $248 million; 5 of these projects were approved in 2008 (Coal Age, 2008).

Neyveli Lignite Corp. Ltd. (NLC) was a leading lignite mining and power company in India. NLC had three opencast lignite mines (Mine-I, Mine-IA, and Mine-II) with a combined capacity of 24 Mt/yr and three thermal powerplants with a combined capacity of 2,490 MW. About 87% of the lignite reserves in India are located in the State of Tamil Nadu. NLC had measured lignite reserves of 4,150 Mt in an area of 480 km^2. NLC planned to expand the production capacity of Mine-II to 15 Mt/yr from 10.5 Mt/yr. NLC also planned to develop a lignite mine at Barsingsar in the State of Rajasthan with a capacity of 2.1 Mt/yr (Neyveli Lignite Corp. Ltd., 2008).

Great Eastern Energy Corp. Ltd., which was a pioneer in the exploration and development of coalbed methane (CBM) in India, commissioned a brand new drill rig, which enabled the startup of a new CBM development program in a licensed area that covered 210 km^2. The company completed 23 vertical production wells and 8 core holes. The wells would be connected by an internal pipeline network to gas-gathering stations. CBM would supplement domestic supplies of gas to help address the growing demand for gas. Demand for gas in the licensed area was estimated to be 4.3 to 5.7 million cubic meters per day, which was more than double the company's peak expected production level (Great Eastern Energy Corp. Ltd., 2008).

Natural Gas.—The $7.6 billion 2,700-km Iran-Pakistan-India (IPI) gas pipeline would have a capacity to carry 54 billion cubic meters per year of gas; 32 billion cubic meters of gas would be supplied to India and 22 billion cubic meters would go to Pakistan. The IPI project could become an Iran-Pakistan-China project when India delayed its participation in the joint venture. The Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline proposed in 2001 for the supply of natural gas to India would cover a distance of 1,800 km. India joined the project in April 2008. In addition to an estimated cost for the project of $8 billion, there remained the question of whether Turkmenistan had enough natural gas to fill the pipeline. India's interest in joining the pipeline project was in opening exploration and development opportunities for Turkmenistan's gas reserves in addition to receiving gas from Turkmenistan. The TAPI project might not be realized (Petroleum Economist, 2008).

Petroleum.—The Government called for selling old oilfields to let the private sector deploy technologies that could enhance oil recovery from the fields without raising Government spending. India imported about 72% of its crude oil requirement. To reduce the dependence on oil imports, the Government was considering accelerating its exploration for oil and gas. Since 1999, the reward of 162 new areas for exploration under the New Exploration Licensing Policy had led to 46 oil and gas discoveries and added 600 Mt of oil equivalent to the country's hydrocarbon reserves (Alexander's Gas & Oil Connections, 2008a).

Uranium.—The Government planned to invest $175 million in exploring for uranium in the States of Andhra Pradesh, Karnataka, Meghalaya, and Rajasthan because the country has limited reserves (about 80,000 t) of uranium, and its uranium production of 300 t/yr was insufficient to meet its requirement of 500 t/yr. Also, India wanted to build more nuclear powerplants to meet its rising energy demands but could not import the natural uranium required to fuel its reactors. The currently installed generating capacity of nuclear power was 3,360 MW. State-owned Uranium Corp. of India Ltd. planned to establish new mines and mills in the States of Andhra Pradesh and Meghalaya. The company operated uranium mines at Bhatin, Jaduguda, Narwapahar, and Turamdih in the State of Jharkhand and a processing mill at Jaduguda. The Government could soon allow the private sector in the area of uranium exploration and mining (Minesite.com, 2008).

Reserves and Resources

The country's mineral resources include large deposits of barite, bauxite, chromium, coal, iron ore, limestone, and manganese. Barite deposits occur in the State of Andhra Pradesh. Iron ore deposits in the form of hematite and magnetite occur in the States of Bihar, Karnataka, Madhya Pradesh, Orissa, and Tamil Nadu. India's coal resources amounted to 250 Gt and are located in the States of Andhra Pradesh, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Orissa, and West Bengal. Its lignite reserves total 38 Gt and are found in the States of Gujarat, Jammu and Kashmir, Kerala, Rajasthan, and Tamil Nadu (table 3).

Outlook

It is expected that India will need major investment in its mineral industry in the next 5 to 10 years to support and sustain its high rate of economic growth. The key mining segments for investment include coal, metallic ores, and mining equipment. The value of mineral industry output is expected to reach $30 billion and to account for 2.5% of the GDP within the next 4 years. India's need for energy (particularly coal) is expected to continue to encourage the modernization of its mining sector, and to result in more productive and environmentally sustainable mines. The country's production of bauxite, alumina, and aluminum is expected to increase owing to new mines and plants and expansions of production capacities. The country is likely to achieve a crude steel production capacity of 124 Mt/yr in fiscal year 2011-12 with the startup of new steel plants and the completion of expansion projects, such as those planned by ArcelorMittal, POSCO, and MSP Steel. India has abundant heavy mineral sands. Production of monazite, titanium minerals, and zircon are all expected to increase. The country is expected to become a significant producer of rare earths in the next few years. Owing to mergers and capacity additions, India's output of cement is expected to reach 335 Mt/yr in 5 years.

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TABLE 1

INDIA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1,2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
METALS						
Aluminum:						
Bauxite, gross weight	thousand metric tons	11,285 [4]	12,385 [4]	13,940 [4]	20,343 [r,4]	21,210 [4]
Alumina, Al_2O_3 equivalent	do.	2,600	2,700	2,800	2,900	3,000
Metal, primary		860,900 [r,4]	942,400 [4]	1,105,100 [r,4]	1,221,800 [r,4]	1,307,500 [4]
Cadmium metal		489 [4]	409 [4]	457 [4]	580 [4]	599 [4]
Chromium, chromite, gross weight		2,948,944 [4]	3,255,162 [4]	3,600,400 [4]	3,320,000 [4]	3,900,000 [4]
Cobalt metal		545 [4]	1,220 [4]	1,184 [4]	980 [4]	858 [4]
Copper:						
Mine output, Cu content		29,500 [4]	26,900 [4]	27,400 [4]	33,900 [r,4]	30,600 [4]
Metal, primary:						
Smelter		401,000 [4]	486,600 [4]	610,000 [4]	500,400 [4]	643,800 [4]
Refinery:						
Electrolytic, cathode		399,000 [4]	477,000 [r,4]	614,000 [r,4]	713,600 [r,4]	669,200 [4]
Fire refined		20,000	20,000	15,000	15,000	15,000
Total		419,000	497,000 [r]	629,000 [r]	729,000 [r]	684,000
Gold metal, smelter	kilograms	3,700 [4]	3,100 [4]	2,400 [4]	3,000 [4]	2,700 [4]
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand metric tons	120,600 [4]	152,000 [4]	177,000 [4]	207,000 [r,4]	220,000 [4]
Fe content	do.	77,200 [4]	97,500 [4]	113,000 [4]	126,000 [r,4]	141,000 [4]
Metal:						
Pig iron	do.	25,117 [4]	27,125 [4]	28,300 [4]	28,800 [4]	29,000 [4]
Direct-reduced iron	do.	9,370 [4]	12,040 [4]	14,740 [4]	18,100 [4]	20,200 [4]
Ferroalloys:						
Ferrochromium, including charge chrome		527,100 [4]	611,373 [4]	634,200 [4]	820,000 [r,4]	750,000 [4]
Ferrochromiumsilicon		10,000	10,000	10,000	10,000	10,000
Ferromanganese		204,800 [r,4]	192,900 [r,4]	180,000	180,000	170,000
Ferrosilicon		55,000	56,000	58,000	60,000	62,000
Silicomanganese		96,893 [r,4]	69,224 [r,4]	80,000 [r]	80,000 [r]	90,000
Other		9,000	9,000	9,000	9,000	9,000
Steel, crude	thousand metric tons	32,600 [4]	45,800 [4]	49,500 [4]	53,100 [4]	55,200 [4]
Semimanufactures[5]	do.	38,421 [4]	42,947 [4]	45,000	47,000	49,000
Lead:						
Mine output, Pb content		51,300 [4]	60,400 [4]	69,200 [4]	77,500 [r,4]	87,300 [4]
Metal, refined:						
Primary		40,000 [4]	56,000 [4]	49,600 [r,4]	53,800 [r,4]	62,000 [4]
Secondary		25,000 [4]	35,000 [4]	55,600 [r,4]	70,000 [r,4]	76,000 [4]
Total		65,000 [4]	91,000 [4]	105,200 [r,4]	123,800 [4]	138,000 [4]
Manganese:						
Ore and concentrate, gross weight	thousand metric tons	1,776 [4]	2,386 [4]	2,084 [r,4]	2,300	2,400
Mn content	do.	630	927 [4]	844 [r,4]	900	960
Rare-earth metals, monazite concentrate, gross weight		5,000	5,000	5,000	5,000	5,000
Selenium	kilograms	12,000	13,000	13,000	14,000	14,000
Silver, mine and smelter output	do.	14,500 [4]	31,500 [4]	30,900 [4]	82,300 [r,4]	96,000 [4]
Titanium mineral concentrates, gross weight:						
Ilmenite		621,000	686,000	690,000	700,000	720,000
Rutile		19,600	20,100	21,000	21,000	21,000
Zinc:						
Mine output, concentrate:						
Gross weight		340,000 [r,4]	447,100 [r,4]	501,700 [r,4]	538,900 [r,4]	613,600 [4]
Zn content		191,000	262,000	294,000	314,000	337,000

See footnotes at end of table.

TABLE 1—Continued
INDIA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
METALS—Continued						
Zinc—Continued:						
Metal:						
Primary		238,400 [4]	266,200 [4]	420,900 [4]	430,800 [r, 4]	545,800 [4]
Secondary		24,000	23,000	23,000	23,000	22,000
Total		262,000	289,000	444,000	454,000 [r]	568,000
Zirconium concentrate, zircon, gross weight		25,400	26,700	28,000	29,000	30,000
INDUSTRIAL MINERALS						
Abrasives, natural, n.e.s.:[6]						
Corundum, natural	kilograms	1,100	1,100	1,000	1,000	1,000
Garnet		125,000	120,000	115,000	120,000	125,000
Jasper		8,500	8,700	8,800	9,000	8,900
Asbestos		18,000	19,000	20,000	21,000	20,000
Barite		1,100,000	1,200,000	950,000	1,000,000	1,100,000
Bromine, elemental		1,500	1,500	1,500	1,500	1,500
Cement, hydraulic	thousand metric tons	130,000	145,000	160,000	170,000	180,000
Chalk		115,000	120,000	120,000	125,000	125,000
Clays:						
Ball clay		400,000	420,000	420,000	430,000	430,000
Diaspore		11,000	11,000	10,000	10,000	10,000
Fireclay		365,000	370,000	375,000	380,000	390,000
Kaolin:						
Salable crude	thousand metric tons	550	560	560	570	570
Processed	do.	180	190	200	200	210
Total	do.	730	750	760	770	780
Other	do.	75	80	80	85	85
Diamond:						
Gem	thousand carats	16	16	15	15	15
Industrial	do.	43	42	40	40	38
Total	do.	59	58	55	55	53
Feldspar		367,346 [r, 4]	414,637 [r, 4]	386,685 [r, 4]	397,328 [r, 4]	400,000
Fluorspar:						
Concentrates, metallurgical-grade		6,400	6,500	5,800	5,000	5,500
Other fluorspar materials, graded		4,300	4,400	500	1,000	1,500
Gemstones, excluding diamond:						
Agate, including chalcedony pebble		200	180	180	170	160
Garnet	kilograms	850	850	800	800	800
Graphite[7]		120,000	130,000	120,000	130,000	140,000
Gypsum		2,350,000	2,400,000	2,450,000	2,500,000	2,550,000
Kyanite and related materials:						
Kyanite		6,200	6,800	7,000	7,300	7,500
Sillimanite		14,500	15,000	15,000	15,200	16,000
Lime		900,000	920,000	910,000	900,000	910,000
Magnesite		370,000	380,000	370,000	360,000	350,000
Mica:						
Crude		1,600	1,600	1,700	1,700	1,700
Scrap and waste		2,100	2,100	2,200	2,200	2,300
Total		3,700	3,700	3,900	3,900	4,000
Nitrogen, N content of ammonia	thousand metric tons	10,718 [4]	10,800	10,900	11,000	11,100
Phosphate rock, including apatite		1,180,000	1,200,000	1,200,000	1,210,000	1,220,000
Pigments, mineral, natural, ocher		360,000	360,000	370,000	375,000	380,000
Pyrites, gross weight		120,000	130,000	125,000	120,000	120,000

See footnotes at end of table.

TABLE 1—Continued
INDIA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
INDUSTRIAL MINERALS—Continued						
Salt:						
Rock salt	thousand metric tons	3	3	3	3	3
Other	do.	15,000	15,500	15,500	16,000	16,000
Total	do.	15,000	15,500	15,500	16,000	16,000
Sand:						
Calcareous	do.	255	260	265	270	275
Silica	do.	1,500	1,600	1,600	1,600	1,700
Other	do.	3,000	3,100	3,200	3,100	3,200
Slate		11,000	12,000	12,500	13,000	13,500
Soda ash		1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Stone, sand and gravel:						
Calcite		52,000	53,000	54,000	54,000	55,000
Dolomite	thousand metric tons	3,000	3,000	3,000	3,100	3,100
Limestone	do.	125,000	120,000	123,000	125,000	127,000
Quartz and quartzite	do.	260	270	270	280	280
Sulfur, byproduct from fertilizer plants		12,000	13,000	14,000	15,000	14,000
Talc and related materials:						
Pyrophyllite		86,000	85,000	86,000	87,000	87,000
Steatite, soapstone		550,000	545,000	560,000	555,000	560,000
Vermiculite		4,400	4,500	4,600	4,700	4,800
Wollastonite		115,000	120,000	125,000	120,000	125,000
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Bituminous	thousand metric tons	330,000	333,000	350,000	380,000	420,000
Lignite	do.	25,000	27,000	26,000	25,000	26,000
Total	do.	355,000	360,000	376,000	405,000	446,000
Gas, natural:						
Gross	million cubic meters	28,000	29,000	30,000	32,407 [r, 4]	33,061 [4]
Marketable	do.	26,000	27,000	28,000	27,069 [r, 4]	27,457 [4]
Petroleum:						
Crude	thousand 42-gallon barrels	244,000	248,000	250,000	254,000 [r, 4]	253,000 [4]
Refinery products:						
Liquefied petroleum gas	do.	44,000	45,000	45,000	49,000 [r, 4]	53,000 [4]
Gasoline	do.	70,000 [r]	75,000 [r]	85,000 [r]	101,000 [r, 4]	119,000 [4]
Kerosene and jet fuel	do.	110,000 [r]	115,000 [r]	120,000 [r]	127,000 [r, 4]	122,000 [4]
Distillate fuel oil	do.	370,000 [r]	380,000 [r]	400,000 [r]	432,000 [r, 4]	468,000 [4]
Residual fuel oil	do.	71,000	85,000 [r]	100,000 [r]	117,000 [r, 4]	130,000 [4]
Other	do.	325,000 [r]	335,000 [r]	340,000 [r]	330,000 [r, 4]	319,000 [4]
Total	do.	990,000 [r]	1,040,000 [r]	1,090,000 [r]	1,156,000 [r, 4]	1,211,000 [4]

[r] Revised. do. Ditto.

[1] Estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2] Table includes data available through October 19, 2009.

[3] In addition to commodities listed, other gemstones (aquamarine, emerald, ruby, and spinel) and uranium are produced, but output is not reported, and available information is inadequate to make reliable estimates of output.

[4] Reported figure.

[5] Excludes production from steel miniplants.

[6] Not elsewhere specified.

[7] India's marketable production is 10% to 20% of mine production.

TABLE 2
INDIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Alumina	Indian Aluminium Co. Ltd. [Indian interests, 60.4%, and Alcan Aluminium Ltd., 39.6%]	Belgaum refinery, Karnataka	280
Do.	National Aluminium Co. Ltd. (Indian Government, 100%)	Dhamanjodi refinery, Orissa	1,580
Do.	Bharat Aluminium Co. Ltd. [Indian Government, 49%, and Sterlite Industries (India) Ltd., 51%]	Korba refinery, Chhattisgarh	200
Do.	Utkal Alumina International Ltd. (Hindalco Industries Ltd., 100%)	Koraput refinery, Orissa	1,500[1]
Do.	Madras Aluminium Co. Ltd. [Sterlite Industries (India) Ltd., 80%, and others, 20%]	Mettur refinery, Tamil Nadu	80
Do.	Indian Aluminium Co. Ltd. [Indian interests, 60.4%, and Alcan Aluminium Ltd., 39.6%]	Muri refinery, Jharkhand	88
Do.	Hindalco Industries Ltd. (Birla Group, 33%; foreign investors, 26%; private Indian investors, 23%; financial institutions, 18%)	Renukoot refinery, Uttar Pradesh	450
Aluminum	Indian Aluminium Co. Ltd. [Indian interests, 60.4%, and Alcan Aluminium Ltd., 39.6%]	Alupuram smelter, Kerala	20
Do.	National Aluminium Co. Ltd. (Indian Government, 100%)	Angul smelter, Orissa	345
Do.	Indian Aluminium Co. Ltd. [Indian interests, 60.4%, and Alcan Aluminium Ltd., 39.6%]	Belgaum smelter, Karnataka	70
Do.	Hindalco Industries Ltd. (Birla Group, 33%; foreign investors, 26%; private Indian investors, 23%; financial institutions, 18%)	Hirakud smelter, Orissa	100
Do.	Bharat Aluminium Co. Ltd. [Indian Government, 49%, and Sterlite Industries (India) Ltd., 51%]	Korba smelters, Chhattisgarh	350
Do.	Madras Aluminium Co. Ltd. [Sterlite Industries (India) Ltd., 80%, and others, 20%]	Mettur smelter, Tamil Nadu	40
Do.	Hindalco Industries Ltd. (Birla Group, 33%; foreign investors, 26%; private Indian investors, 23%; financial institutions, 18%)	Renukoot smelter, Uttar Pradesh	275
Barite	Andhra Pradesh Mineral Development Corp. Ltd. (Andhra Pradesh State government, 100%)	Cuddapah District mines, Andhra Pradesh	350
Do.	Associated Mineral Corp.	do.	75
Do.	Pragathi Minerals	do.	50
Do.	Shri C.M. Ram nath Reddy	do.	75
Do.	Vijayalaxmi Minerals Trading Co.	do.	50
Bauxite	Bharat Aluminium Co. Ltd. [Indian Government, 49%, and Sterlite Industries (India) Ltd., 51%]	Amarkantak Mine, Madhya Pradesh	200
Do.	Indian Aluminium Co. Ltd. [Indian interests, 60.4%, and Alcan Aluminium Ltd., 39.6%]	Kolhapur District mines, Maharashtra	600
Do.	Gujarat Mineral Development Corp. (Gujarat State government, 100%)	Kutch and Saurashtra Mines, Gujarat	500
Do.	Hindalco Aluminium Co. Ltd. (Birla Group, 33%; foreign investors, 26%; private Indian investors, 23%; financial institutions, 18%)	Mines in Lohardaga District, Jharkhand	750
Do.	Indian Aluminium Co. Ltd. [Indian interests, 60.4%, and Alcan Aluminium Ltd., 39.6%]	do.	200
Do.	National Aluminium Co. Ltd. (Indian Government, 100%)	Mines in Panchpatmali Hills, Koraput District, Orissa	4,800
Do.	Minerals & Minerals Ltd. (Indian Government, 100%)	Mines in Richuguta, Palamau District, Jharkhand	200
Borax	Borax Morarji Ltd.	Ambernath, Maharashtra	17
Cement	Larsen and Toubro Ltd.	Awarpur plant, Maharashtra	2,300
Do.	Century Cement (Century Textiles and Industries Ltd., a subsidiary of the Birla Group, 100%)	Baikunth plant, Madhya Pradesh	1,120
Do.	Ambuja Cements Ltd. (Holcim Group, 14.8%)	Plants in 7 States	14,000

See footnotes at end of table.

TABLE 2—Continued
INDIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Cement—Continued	Coromandel Fertilizers Ltd. [Chevron Chemical Co. (United States), 23.55%; International Minerals and Chemical Co., 20.89%; Parry and Co., 10.64%; E.I.D. Parry (India) Ltd., 6.65%; others, 38.27%]	Chilamkur plant, Andhra Pradesh	1,000
Do.	The Associated Cement Cos. Ltd. (Indian Government, 34.86%, and private shareholders, 65.14%)	Gagal plant, Himachal Pradesh	1,830
Do.	Raymond Cement Works (a division of Raymond Woolen Mills Ltd., JK Singhania, principal shareholder)	Gopalnagar plant, West Bengal	1,250
Do.	Narmada Cement Co. Ltd. (Chowgule and Co. Ltd., 34%; Gujarat State government, 17.33%; others, 48.67%)	Jafrabad plant, Gujarat	1,000
Do.	Rajashree Cement (a division of Indian Rayon and Industries Ltd., 100%)	Khor plant, Karnataka	1,020
Do.	The Associated Cement Cos. Ltd. (Indian Government, 34.86%, and private shareholders, 65.14%)	Kymore plant, Madhya Pradesh	1,500
Do.	Mangalam Cement Ltd.	Morak plant, Rajasthan	1,000
Do.	Mysore Cements Ltd. (Government institutions and banks, 41.13%; Corporate Trust Holdings, 21.70%; others, 37.17%)	Narasingarh plant, Haryana	1,089
Do.	Cement Corp. of India Ltd. (Indian Government, 100%)	Nayagaon plant, Madhya Pradesh	1,330
Do.	JK Cement Works (a division of JK Synthetics Ltd., 100%)	Nimbahera plant, Rajasthan	1,462
Do.	OCL India Ltd.	Orissa	1,850
Do.	The India Cement Co. Ltd. (Indian Government, 26%; Life Insurance Corp. of India, 24%; others, 50%)	Sankarnagar plant, Tamil Nadu	1,000
Do.	Maihar Cement (Century Textiles and Industries Ltd., a subsidiary of the Birla Group, 100%)	Satna plant, Madhya Pradesh	1,800
Do.	Shree Digvijay Cement Co. Ltd.	Shreeniwas plant, Maharashtra	1,070
Do.	Lakshmi Cement (a division of Straw Products Ltd., JK Singhania, principal shareholder)	Sirohi plant, Rajasthan	1,400
Do.	Lafarge S.A.	Sonadih, Chhattisgarh	1,400
Do.	Manikgarth Cement (Century Textiles and Industries Ltd., a subsidiary of the Birla Group, 100%)	Tehsil Rajura plant, Maharashtra	1,000
Do.	Vasavadatta Cement (Kesoram Industries Ltd., 100%)	Vasavadatta plant, Karnataka	1,000
Do.	Vikram Cement (Grasim Industries Ltd., a subsidiary of the Birla Group, 100%)	Vikram plant, Madhya Pradesh	1,000
Do.	Raasi Cement Ltd. (Andhra Pradesh State government, 50%, and Development Co. Ltd., 50%)	Vishnupuram plant, Andhra Pradesh	1,000
Do.	The Associated Cement Cos. Ltd. (Indian Government, 34.86%, and private shareholders, 65.14%)	Wadi plant, Karnataka	2,180
Chromium	Ferro Alloys Corp. Ltd.	Cuttack District, Orissa	120
Do.	Orissa Mining Corp. Ltd. (Orissa Industries Ltd., 100%)	do.	300
Do.	Tata Steel	do.	100
Do.	Ferro Alloys Corp. Ltd.	Dhenkanal District, Orissa	75
Do.	Orissa Mining Corp. Ltd. (Orissa Industries Ltd., 100%)	do.	200
Do.	Mysore Minerals Ltd.	Hassan District, Karnataka	125
Do.	Ferro Alloys Corp. Ltd.	Kendujhar District, Orissa	75
Do.	Orissa Mining Corp. Ltd. (Orissa Industries Ltd., 100%)	do.	100
Do.	Ferro Alloys Corp. Ltd.	Khammam District, Andhra Pradesh	100
Coal, bituminous million metric tons	Bharat Coking Coal Ltd. (a subsidiary of Coal India Ltd., Indian Government, 100%)	Bihar and West Bengal	26
Do. do.	Central Coalfields Ltd. (a subsidiary of Coal India Ltd., Indian Government, 100%)	Bihar	27
Do. do.	Eastern Coalfields Ltd. (a subsidiary of Coal India Ltd., Indian Government, 100%)	Bihar and West Bengal	21
Do. do.	Mahanadi Coalfields Ltd. (a subsidiary of Coal India Ltd., Indian Government, 100%)	Orissa	21

See footnotes at end of table.

TABLE 2—Continued

INDIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Coal, bituminous—Continued million metric tons	North Eastern Coalfields Ltd. [a subsidiary of Coal India Ltd. (Indian Government, 100%)]	Assam	640
Do. do.	Northern Coalfields Ltd. [a subsidiary of Coal India Ltd. (Indian Government, 100%)]	Madhya Pradesh and Uttar Pradesh	24
Do. do.	Singareni Collieries Co. Ltd. (Andhra Pradesh State government, 50%, and Indian Government, 50%)	Andhra Pradesh	18
Do. do.	South Eastern Coalfields Ltd. [a subsidiary of Coal India Ltd. (Indian Government, 100%)]	Madhya Pradesh	36
Do. do.	Western Coalfields Ltd. (a subsidiary of Coal India Ltd., Indian Government, 100%)	Madhya Pradesh and Maharashtra	18
Coal, lignite do.	Neyveli Lignite Corp. Ltd. (NLC) (Indian Government, 100%)	Tamil Nadu	17
Copper, mine	Hindustan Copper Ltd. (HCL) (Indian Government, 100%)	Indian Copper Complex Mines, Ghatsila District, Jharkhand	31
Do.	do.	Khetri Copper Complex Mines, Khetrinagar Rajasthan	15
Do.	do.	Malanjkhand Copper Complex Mines, Balaghar District, Madhya Pradesh	22
Copper, metal	Hindalco Industries Ltd. (Birla Group, 33%; foreign investors, 26%; private Indian investors, 23%; financial institutions, 18%)	Birla Copper Complex smelter, Dahej, Gujarat	70
Do.	Hindustan Copper Ltd. (HCL) (Indian Government, 100%)	Indian Copper Complex smelter-refinery, Ghatsila District, Jharkhand	20
Do.	do.	Khetri Copper Complex smelter-refinery, Khetrinagar District, Rajasthan	45
Do.	Sterlite Industries (India) Ltd.	Tuticorin smelter, Tamil Nadu	400
Do.	do.	Silvassa refinery, Gujarat	300
Diamond carats	Indian Government	Mahjgawan Mine	25,000
Gold kilograms	Hutti Gold Mines Co.	Hutti Mine, Karnataka	3,000
Iron and steel, crude steel	Visvesvaraya Iron and Steel Ltd. [Karnataka State government, 60%, and Steel Authority of India Ltd. (Indian Government, 100%), 40%]	Bhadravati steel plant, Karnataka	180
Do.	Steel Authority of India Ltd. (Indian Government, 100%)	Bhilai steel plant, Jharkhand	4,930
Do.	do.	Bokaro steel plant, Jharkhand	4,600
Do.	Indian Iron and Steel Co. Ltd. [wholly owned subsidiary of Steel Authority of India Ltd. (Indian Government, 100%)]	Burnpur steel plant, West Bengal	1,500
Do.	Ispat Industries Ltd.	Dolvi, Maharashtra	3,000
Do.	Steel Authority of India Ltd. (Indian Government, 100%)	Durgapur steel plant, West Bengal	1,600
Do.	Tata Steel	Jamshedpur steel plant, Jharkhand	5,000
Do.	do.	Jagdalpur, Chattisgarh	2,000
Do.	do.	Duburi, Orissa	3,000
Do.	Steel Authority of India Ltd. (Indian Government, 100%)	Rourkela steel plant, Orissa	1,800
Do.	Rashtriya Ispat Nigam Ltd.	Visakhapatnam steel plant, Andhra Pradesh	3,200
Do.	JSW Steel Co. Ltd.	Vijayanagar, Karnataka	7,000
Do.	Ministeel plants (privately owned)	About 180 plants located throughout India	4,700
Do.	Essar Steel Co. Ltd.	Hazira, Gujarat	3,000
Do.	Lloyds Steel Industries Ltd.	Wardha, Maharashtra	500
Do.	MSP Steel and Power Ltd.	Raipur, Chhattisgarh	750
Iron ore	National Mineral Development Corp. Ltd. (NMDC) (Indian Government, 100%)	Bailadila, Chhattisgarh	9,000
Do.	Steel Authority of India Ltd. (Indian Government, 100%)	Bastar and Durg District, Chhattisgarh	7,000
Do.	Kudremukh Iron Ore Co. Ltd. (Indian Government, 100%)	Kudremukh, Chikmagalur District, Karnataka	10,300

See footnotes at end of table.

TABLE 2—Continued
INDIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity^e
Iron ore—Continued	National Mineral Development Corp. Ltd. (NMDC) (Indian Government, 100%)	Donimalai, Karnataka	9,000
Do.	Chowgule and Co. Ltd.	Goa	2,500
Do.	Dempo Mining Corp. Ltd.	do.	2,500
Do.	V.M. Salgaocar & Bros. Pvt. Ltd.	do.	2,500
Do.	Sesa Goa Ltd. (Vedanta Resources plc, 51%)	Codli and Sonshi, Goa	NA
Do.	Steel Authority of India Ltd. (Indian Government, 100%)	Kendujhar District, Orissa	3,000
Do.	Tata Steel	do.	2,000
Do.	Indian Iron and Steel Co. Ltd. [wholly owned subsidiary of Steel Authority of India Ltd. (Indian Government, 100%)]	Singhbhum District, Bihar	2,500
Do.	Steel Authority of India Ltd. (Indian Government, 100%)	do.	3,500
Do.	Tata Steel	do.	3,500
Kyanite	Associated Mining Co.	Bhandara District, Maharashtra	10
Do.	Maharashtra Mineral Corp. Ltd.	do.	10
Do.	Bihar State Mineral Development Corp. Ltd. (Bihar State government, 100%)	Singhbhum District, Bihar	10
Do.	Hindustan Copper Ltd. (HCL) (Indian Government, 100%)	do.	22
Lead:			
Primary	Hindustan Zinc Ltd. (HZL) (Sterlite Opportunities and Ventures Ltd., 64.9%, and Indian Government, 29.5%)	Chanderiya smelters, Rajasthan	85
Do.	do.	Tundoo smelter, Bihar	8
Secondary	Indian Lead Co.	Thane refinery, Mumbai, Maharashtra	25
Do.	do.	Wada, Mumbai, Maharashtra	40
Lead ore	Hindustan Zinc Ltd. (HZL) (Sterlite Opportunities and Ventures Ltd., 64.9%, and Indian Government, 29.5%)	Agnigundala Mine, Andhra Pradesh	72
Do.	do.	Sargipalli Mine, Orissa	150
Lead-zinc ore	do.	Rampura-Agucha Mine, Rajasthan	1,300
Do.	do.	Zawar mine group, Rajasthan	1,200
Magnesite	Burn Standard Co. Ltd. (Indian Government, 100%)	Salem, Tamil Nadu	150
Do.	Dalmia Magnesite Corp.	do.	150
Do.	Tamil Nadu Magnesite Ltd. (Tamil Nadu State government, 100%)	do.	150
Manganese ore[2]	Manganese Ore India Ltd. (Indian Government, 100%)	Adilabad, Andhra Pradesh	NA
Do.	Falechand Marsingdas	Andhra Pradesh	NA
Do.	Manganese Ore India Ltd. (Indian Government, 100%)	Balaghat, Madhya Pradesh	NA
Do.	J.A. Trivedi Bros.	do.	NA
Do.	Sandur Manganese and Iron Ores Ltd.	Bellary, Karnataka	NA
Do.	Manganese Ore India Ltd. (Indian Government, 100%)	Bhandara, Maharashtra	NA
Do.	Eastern Mining Co.	North Kanara, Karnataka	NA
Do.	Mysore Minerals Ltd.	do.	NA
Do.	Manganese Ore India Ltd. (Indian Government, 100%)	Keonjhar, Orissa	NA
Do.	Mangilah, Rungta (Pvt.) Ltd.	do.	NA
Do.	Orissa Mining Corp. Ltd.	do.	NA
Do.	Rungta Mines (Pvt.) Ltd.	do.	NA
Do.	Serajuddin & Co.	do.	NA
Do.	S. Lall & Co.	do.	NA
Do.	Tata Steel	do.	NA
Do.	Orissa Mineral Development Co. Ltd.	Koraput, Orissa	NA
Do.	Orissa Mining Corp. Ltd.	do.	NA
Do.	Mysore Minerals Ltd.	Shimoga, Karnataka	NA
Do.	Aryan Mining & Trading Corp.	Sundargarh, Orissa	NA
Do.	Orissa Manganese & Minerals (Pvt.) Ltd.	do.	NA
Do.	Tata Steel	do.	NA
Do.	R.B.S. Shreeram Durga Prasad and Falechand Marsingdas	Vizianagaram, Andhra Pradesh	NA

See footnotes at end of table.

TABLE 2—Continued

INDIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Mica	metric tons	Micafab India Pvt. Ltd.	Sydapuram Mandal, Andhra Pradesh	4,500
Do.	do.	Premier Mica Co.	Rjupalem, Andhra Pradesh	200
Petroleum, refined products	thousand 42-gallon barrels per day	Cochin Refineries Ltd. [a subsidiary of Oil and Natural Gas Corp. (Indian Government, 55%, and private interests, 45%)]	Ambalamugal refinery, Kerala	93,000
Do.	do.	Indian Oil Corp. (a subsidiary of Oil and Natural Gas Corp. (Indian Government, 91%, and private interests, 9%)]	Barauni refinery, Bihar	66,000
Do.	do.	Bongaigaon Refinery and Petrochemicals Ltd. [a subsidiary of Oil and Natural Gas Corp. (Indian Government, 100%)]	Bongaigaon refinery, Assam	27,000
Do.	do.	Indian Oil Corp. [a subsidiary of Oil and Natural Gas Corp. (Indian Government, 91%, and private interests, 9%)]	Digboi refinery, Assam	12,000
Do.	do.	do.	Guwahati refinery, Assam	20,000
Do.	do.	do.	Haldia refinery, West Bengal	61,000
Do.	do.	do.	Koyali refinery, Gujarat	185,000
Do.	do.	Madras Refineries Ltd. [a subsidiary of Oil and Natural Gas Corp. (Indian Government, 52%, and private interests, 48%)]	Madras refinery, Tamil Nadu	131,000
Do.	do.	Bharat Petroleum Corp. Ltd. [a subsidiary of Oil and Natural Gas Corp. (Indian Government, 67%, and private interests, 33%)]	Mahul refinery, Mumbai, Maharashtra	135,000
Do.	do.	Industan Petroleum Corp. Ltd. [a subsidiary of Oil and Natural Gas Corp. (Indian Government, 51%, and private interests, 49%)]	do.	110,000
Do.	do.	Essar Oil Ltd.	Vadinar refinery, Gujarat	240,000
Do.	do.	do.	Visakhapatnam refinery, Andhra Pradesh	90,000
Do.	do.	Indian Oil Corp. [a subsidiary of Oil and Natural Gas Corp. (Indian Government, 91%, and private interests, 9%)]	Mathura refinery, Uttar Pradesh	156,000
Do.	do.	do.	Panipat refinery, Haryana	240,000
Phosphate rock[3]		Rajasthan State Mineral Development Corp. Ltd. (Rajasthan State government, 100%)	Badgaon, Dakankotra, Kanpur, Kharbaria-ka-Guda, and Sallopat Mines, Rajasthan	NA
Do.		Pyrites Phosphates and Chemicals Ltd.	Durmala and Maldeota underground mines, Uttar Pradesh	NA
Do.		Madhya Pradesh State Mining Corp. Ltd. (Madhya Pradesh State government, 100%)	Hirapur and Khatamba Mines, Jharkhand	NA
Do.		Rajasthan State Mines and Minerals Ltd. (Rajasthan State government, 100%)	Jhamarkotra Mine, Rajasthan	NA
Do.		Hindustan Zinc Ltd. (HZL) (Sterlite Opportunities and Ventures Ltd., 64.9%, and Indian Government, 29.5%)	Maton Mine, Rajasthan	NA
Titanium, ilmenite-rutile ore		Kerala Minerals and Metals Ltd. (Kerala State government, 100%)	Chavara, Kerala	100
Do.		Indian Rare Earths Ltd. (IREL) (Indian Government, 100%)	do.	250
Do.		do.	Ganjam, Orissa	220
Do.		do.	Manavalakurichi, Tamil Nadu	65
Do.		VV Minerals Ltd.	Kanyakumari, Tamil Nadu	130
Zinc		Binani Zinc Ltd.	Binanipuram smelter, Kerala	38
Do.		Hindustan Zinc Ltd. (HZL) (Sterlite Opportunities and Ventures Ltd., 64.9%, and Indian Government, 29.5%)	Chanderiya smelter, Rajasthan	340
Do.		do.	Debari smelter, Rajasthan	78
Do.		do.	Visakhapatnam (Vizag) smelter, Andhra Pradesh	54

[e] Estimated. Do., do. Ditto. NA Not available.

[1] Scheduled startup is delayed to 2011.

[2] Capacity of clusters of surface mines varies extremely, depending on demand. Estimated total capacity is 1.8 million metric tons per year (Mt/yr).

[3] Estimated total phosphate rock capacity is 1.2 Mt/yr.

TABLE 3

INDIA: ESTIMATED RESERVES OF MAJOR MINERAL COMMODITIES IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Reserves
Barite		32,000
Bauxite		539,000
Chromium, in ore		31,000
Coal:		
Bituminous		96,000,000
Lignite		38,000,000
Copper, in ore		135,000
Gold, in metal	kilograms	67,000
Graphite		5,200
Ilmenite and rutile		193,000
Iron, in ore		4,900,000
Kyanite and sillimanite		1,380
Lead and zinc, in ore		63,000
Limestone		7,500,000
Magnesite		21,000
Manganese, in ore		77,000
Phosphate rock		6,100
Talc and pyrophyllite		74,600
Zircon		28,000

Source: Indian Minerals Yearbook 2007, Indian Burau of Mines.

THE MINERAL INDUSTRY OF INDONESIA

By Chin S. Kuo

The Government of Indonesia expected the economy to grow by 6.1% in 2008, fueled by the global boom in commodity prices and the strong domestic construction sector. Indonesia is rich in mineral resources, including coal, copper, gold, nickel, and tin. Other mineral commodities that the country has in significant quantity are bauxite, oil and gas, and silver. The country's industrial production came from the cement, metal mining, and oil and gas industries. Indonesia was among the leading five producers of copper and nickel in the world and its tin output was ranked second after China. It was also ranked among the world's top 10 countries in the production of gold and natural gas. Indonesia was also one of the leading exporters of liquefied natural gas (LNG) (after Qatar) but was a net importer of oil.

Minerals in the National Economy

Indonesia's industrial output accounted for 37% of its gross domestic product (GDP) of $511 billion. The industrial sector grew by 4.8% in 2008. The development of minerals and oil and gas continued to play a significant role in the country's economic growth. Mining and quarrying accounted for 8.9% of the GDP; the cement industry, 0.8%; and iron and steel production, 0.5%. The mining and quarrying sector grew by only 0.5%. The oil and gas industry, which contracted slightly by 0.3%, contributed 3.9% of the GDP (Indonesian Ministry of Industry, 2009).

Government Policies and Programs

Under a new mining and coal law that was under consideration, all existing mining and coal contracts would be upheld. In 5 years after the new law was passed, exports of raw materials would be banned and raw ore and concentrates would be required to be smelted or refined in Indonesia. A provision in the law would shorten mining contracts from the current 30 years to 20 years with an option to extend them for an additional 20 years (Mineweb.com, 2008a).

The Government issued guidelines to limit production of key minerals, including copper, gold, iron ore, nickel, and tin, to ensure domestic supplies and reduce future exports. The limit would be in place for 5 years and would be evaluated annually. The evaluation would take into consideration conservation needs, export demand, domestic supply, national production, and state revenue, as well as the mineral reserves available in each Province and producing area (Thomson Reuters Metals Insider, 2008a).

The Government planned to offer new incentives to attract developers to its declining oil and gas sector, including the elimination of the value-added tax on imported equipment, which took effect in 2008. The Government also set an oil output target of 1.034 million barrels per day in 2008 and 1.3 million barrels per day in 2009 (Petroleum Economist, 2008a).

Production

Indonesia produced such major mineral commodities as bauxite, cement, coal, copper, natural gas, nickel, petroleum, and tin in 2008. Production of mined gold and copper decreased by 45% and 17.8%, respectively, owing to the lower grade ore mined at Grasberg. As a result, the output of refined copper also declined. Production of steel and pig iron also decreased by 10% and 9.1%, respectively, because of low capacity utilization by PT Krakatau Steel. The decrease in the output of mined nickel led to decreased production of ferronickel and nickel matte. The output of mined tin and tin metal also decreased by 19.5% and 16.6%, respectively, owing to the low commodity price. The country produced about 189 million metric tons (Mt) of bituminous coal and an average of 978,000 barrels per day (bbl/d) of oil in 2008, which was short of its targeted output of 1.034 million barrels per day. The amount of natural gas produced and marketed increased slightly by 3%. Indonesia was the leading producer and exporter of LNG in Asia (table 1).

Structure of the Mineral Industry

The Government's investment policy was to encourage domestic and foreign companies to participate in the development and exploitation of minerals and hydrocarbons. State-owned PT Antam Tbk (Antam) produced bauxite, gold, nickel, and silver. PT Krakatau Steel, PT Pertamina, PT Tambang Batubara Bukit Asam, and PT Tambang Timah Tbk were engaged in the production of steel, oil, coal, and tin, respectively. Private-sector PT Indocement Tunggal Prakarsa Tbk was the leading cement producer in the country. Partially foreign-owned PT Freeport Indonesia and PT Newmont Nusa Tenggara were involved in the mining of copper and gold. PT International Nickel Indonesia Tbk produced nickel ore and matte, and PT Koba Tin produced tin ore and tin metal (table 2).

Mineral Trade

In 2008, Indonesia's total exports were valued at $137 billion and the major export partners were China, India, Japan, the Republic of Korea, Malaysia, Singapore, and the United States. Mining and quarrying contributed 10.8% to the value of total exports. Total imports were valued at $129 billion and the major import partners were China, Japan, and Singapore. Iron and steel accounted for 8.4% of the value of total imports. The export value of oil and gas decreased to $29.1 billion owing to falling prices. The value of oil and gas imports amounted to $30.6 billion (Indonesian Ministry of Industry, 2009).

The export volume of refined tin was 9,914 metric tons (t) in January 2008, which was greater than the 5,716 t exported in January 2007 mainly because 14 independent smelters on Bangka and Belitung received licenses to export beginning in 2008. The Government issued tin export licenses to PT Bangka

Kudai Tin and PT Bangka Timah Utama Sejahtera. However, more smelters planned to export less and the total planned export volume for the year was expected to be only 85,000 t, of which PT Tambang Timah would export 60,000 t; PT Koba Tin, 15,000 t; and small smelters, 10,000 t (ITRI Ltd., 2008).

Commodity Review

Metals

Aluminum.—National Aluminium Co. Ltd. of India planned to build a $3.2 billion aluminum smelter and powerplant in the Province of South Sumatra. In its first phase, the smelter would have a production capacity of 250,000 metric tons per year (t/yr) and the coal-fired powerplant would have 750 megawatts (MW) of capacity. In the second phase, the smelter's capacity would be doubled to 500,000 t/yr and the powerplant's capacity would be increased by 500 MW. The project would require 1 million metric tons per year (Mt/yr) of alumina from sources in India. Coal supplies would come from the Tanjung Enim coal mine, which was operated by state-owned PT Tambang Batubara Bukit Asam. The smelter was expected to start operation by the end of 2010. Indonesia's only aluminum smelter was run by state-owned PT Indonesia Asahan Aluminum in the Province of North Sumatra (Mineweb.com, 2008b).

Copper and Gold.—To reduce the environmental effects, the Government cut PT Freeport Indonesia's production by 80,000 metric tons per day (t/d) to 220,000 t/d of ore at Papua's Grasberg copper and gold mine. Freeport-McMoRan Copper and Gold Inc. of the United States held an 81.28% stake in Freeport Indonesia; the Government held a 9.36% interest, and Indocopper Investama held a 9.36% interest (Platts.com, 2008).

PT Smelting Co. planned to expand the capacity at its copper smelter at Gresik in the Province of East Java to 300,000 t/yr from its current capacity of 270,000 t/yr in September 2009. In May 2008, the smelter was shut down for routine maintenance for 27 days to replace the refractory bricks in its furnace. Cathode copper production for the year was about 260,000 t owing to the smelter closure. The smelter was owned by Mitsubishi Materials Corp. of Japan (60.5%), Freeport Indonesia (25%), Mitsubishi Corp. of Japan (9.5%), and Nippon Mining and Metals Co. Ltd. of Japan (5%). The smelter processed about 1 Mt/yr of copper concentrate, of which 80% was supplied by Freeport Indonesia and 20%, by PT Newmont Nusa Tenggara (Thomson Reuters Metals Insider, 2008b).

PT Indosmelt planned to set up a copper smelter with a production capacity of 100,000 t/yr of copper cathode at Maros in South Sulawesi Province. The investment was estimated to be $500 million. The smelter planned to process 250,000 t/yr of copper concentrate secured from Freeport Indonesia or from imports. Ausmelt technology would be used to treat the copper concentrate. Construction of the smelter would start in 2010 and production was expected in 2013. Meanwhile, PT Nusantara Smelting Corp. planned to build a copper smelter that would produce 200,000 t/yr of copper cathode at Bontang on Kalimantan Island (Mining Weekly, 2008).

Oropa Resources Ltd.'s Sihayo 1 North deposit in the Pungkut gold project in the Province of North Sumatra was estimated to have a resource of 12.1 Mt at a grade of 2.4 grams per metric ton (g/t) gold or 28,300 kilograms (kg) of contained gold at a cutoff grade of 1 g/t gold. The company owned 75% of the project and planned an infill drilling program and a bankable feasibility study. A scoping study of the project also included the Hutabargot Julu and the Sambung deposits. Antam held the remaining 25% interest in the project. The company also drilled for gold mineralization in the Old Camp Area east of Sihayo 1 North (Asia Miner, The, 2008i).

Finders Resources Ltd. planned to produce between 20,000 and 25,000 t/yr of copper cathode at its Wetar copper project (formerly owned by BHP Billiton plc of the United Kingdom) in 2009. Heap leaching with solvent extraction and electrowinning was selected as the process with the highest copper recoveries and the lowest capital and operating costs. In mid-2008, the development of a semicommercial-scale test heap (100,000 t) and pilot plant at a capital cost of $6.25 million was underway to produce 5 t/d of copper cathode. The pilot plant production was delayed owing to delays in the supply of several key components. The total resource was estimated to be 9.8 Mt at a grade of 2.5% copper. Finders' Ojolali silver-gold project in South Sumatra Province would be developed as an open pit carbon-in-leach or carbon-in-pulp operation with 1,560 kilograms per year (kg/yr) of gold at the Jambi oxide (more than 85%) deposit. The Jambi deposit's resource estimate was increased by 33% to 4,290 kg of contained gold at a cutoff grade of 0.5 g/t gold. About 75% of the estimated resource was classified as indicated (Finders Resources Ltd., 2008).

Newmont Mining Corp. of the United States filed for arbitration in a dispute concerning the Government's demand that the company sell part of its Batu Hijau Mine on Sumbawa Island to local investors or lose its operating contract. The Government also planned to go to arbitration. The Government decision triggered a requirement for Newmont's local unit PT Newmont Nusa Tenggara to file for arbitration. A cancellation of Newmont's contract to mine copper and gold might undermine overseas investors' confidence in the metals-rich country (Mining Engineering, 2008).

East Asia Minerals Corp. of Canada encountered surface high-grade epithermal gold at its Abong and Collins projects in Aceh Province. High-grade gold was identified with the Bintang and the Fikri prospects at Abong. The company completed the first three planned drill holes. The drilling extended the main Bulan gold mineralization, which is located 400 meters (m) south of Bintang, to the west and led to the discovery the Kapar gold target 1.3 kilometers (km) east of Bulan. At Collins, which is located 80 km northeast of Abong, sampling of the epithermal quartz veins was completed and diamond-sawed channels returned high gold assays. The company also drilled for epithermal gold and silver mineralization at the Binebase-Bawone prospect, which was part of the Sangihe property in North Sulawesi Province (Asia Miner, The, 2008f). Southern Arc Minerals drilled one hole at the Blongas I target that showed insignificant copper-gold values and two holes at the Kekalik target that had low-grade gold intercepts, all in its Selodong porphyry copper-gold prospect on West Lombok Island (Asia Miner, The, 2008e).

An initial resource estimate for the Newet Vein at Kalimantan Gold Corporation Ltd. of Bermuda's Jelai gold project in the Province of East Kalimantan showed an indicated resource of 256,000 t at grades of 3.44 g/t gold and 3.2 g/t silver and an inferred resource of 690,000 t at grades of 2.81 g/t gold and 3.7 g/t silver, both at a cutoff grade of 1 g/t gold. The vein was one of the five main veins identified at Jelai and was a typical low-sulfidation epithermal vein, striking generally north-south and dipping at 60 degrees to the west. The other veins being evaluated included the Lipan, the Nyabi, and the Sembawang veins (Asia Miner, The, 2008g).

Australian company Oxiana Ltd. (which became OZ Minerals Ltd. in 2008) had spent $2.5 million drilling 16 holes to test the four highest-potential targets of Kalimantan Gold's KSK porphyry copper-gold contract of work (COW). A new report confirmed the untested potential in several areas of the COW as supported by Kalimantan Gold's earlier work and the recommendations of its consultants. Meanwhile, Oxiana started construction of its Martabe gold and silver project in the Province of North Sumatra in July 2008. The project was based on the single Purnama deposit, which had a mine life of 9 years, and two other adjacent deposits. The capital cost was estimated to be $310 million. Mining of the Purnama deposit would be undertaken by open pit method and the plant would treat 4.5 Mt/yr of ore using carbon-in-leach technology to recover 6,220 kg/yr of gold and 62,200 kg/yr of silver. Plant completion was scheduled for December 2009. Plant expansion to 9,330 kg/yr was planned for the future. PT Thiess Contractors Indonesia was awarded a $26 million contract for site preparation and early construction work (Asia Miner, The, 2008h).

Antam and Oxiana signed a memorandum of understanding for Antam to acquire a 25% interest in Oxiana's Martabe project for more than $133 million. In the first deal, Antam would purchase 10% of Martabe for $66.5 million. Antam would also be granted an option to buy another 10% for the same price and an additional 5% based on the project's market value at that time (Asia Miner, The, 2008a).

Iron and Steel.—Coziron Resources Ltd. of Australia and Wuhan Tongrui Industry and Trade Ltd. of China signed an agreement to develop the Agam iron sand project in the Province of West Sumatra. The project was a joint venture between Coziron Resources and PT Galian Endapan Buana. The total area of the two licensed tenements was approximately 3,960 hectares. Concentrations of heavy mineral sands, which were thought to have derived from andesitic lavas, contained between 1% and 5% magnetite, as well as rutile and zircon. Wuhan Tongrui would provide technical support as well as mining equipment, a beneficiation plant, and wharf construction for $2.2 million. In return, Wuhan Tongrui would initially take 30,000 metric tons per month of iron sand concentrate from the project. Production was expected to begin in the first quarter of 2009 (Coziron Resources Ltd., 2008).

ArcelorMittal of Luxembourg planned to invest $8 billion in Indonesia to ensure key supplies of iron ore and to create a partnership with Antam to prospect for iron ore, manganese, and nickel. The company relied on suppliers of iron ore, such as BHP Billiton, Rio Tinto plc of the United Kingdom, and Vale S.A. of Brazil. ArcelorMittal also planned to take a stake in PT Krakatau Steel and to set up a new steel plant in a joint venture with PT Krakatau Steel. PT Krakatau Steel had a production capacity of 2.5 Mt/yr of steel (Yuniar, 2008).

Nickel.—Rio Tinto discovered a 162-Mt lateritic nickel resource at its Sulawesi nickel project. The laterite deposits are located 40 km from the east coast on Sulawesi Island and contain limonite and saprolite over ultramafic rock units. The area of laterite deposits within Rio Tinto's leases cover 84 square kilometers. A total of 46 diamond core drillings were used to arrive at an inferred resource of 111 Mt with grades of 1.41% nickel and 0.1% cobalt. Use of open cut mining with excavator and truck was determined to be suitable for the deposits. High-pressure acid leaching could be used to process the ore with 90% nickel recovery and 88% cobalt recovery. A production rate of 46,000 t/yr of nickel was envisaged beginning in 2015 (Rio Tinto plc, 2008).

BHP Billiton decided to end a study into integrated nickel development at Gag Island and Buli in Halmahera following a conditional agreement to form a joint venture with Antam. Obtaining the COW for Buli resource by October 2008 was not achieved. BHP Billiton would not pursue a standalone development at Gag Island and elected to terminate the agreement with Antam (Asia Miner, The, 2008b).

Tin.—PT Tambang Timah was switching from onshore mining of tin to offshore mining owing to depleting onshore resources. Supply of tin-in-concentrate from onshore mining had been in decline. The company planned to build additional dredges to increase offshore mining—seven small dredges at a total cost of $16.3 million and one large dredge at a cost of $21.7 million. These dredges would increase its tin ore from offshore mining to 50% in 2009 compared with 20% in 2008. With China becoming a net importer of tin in 2008, Indonesia was Asia's leading exporter of tin (Mineweb.com, 2008c).

PT Koba Tin's smelters on Bangka and Belitung Islands were shut down because the company received tin ore from illegal mining. Five company officials were named as suspects. Two miners working as the company's partners were alleged to have conducted illegal mining in a forest area. About 5,280 t of refined tin ingots was confiscated. The Government had begun cracking down on illegal tin mining and smelting in 2006. PT Koba Tin, which was the second ranked tin miner and producer in Indonesia, was owned by Malaysian Smelting Corp. Bhd (75%) and PT Tambang Timah (25%). The company planned to produce 15,000 t of refined tin in 2008 (Reuters, 2008).

Industrial Minerals

Cement.—The Government encouraged state-owned cement companies to increase their production capacities to meet domestic demand, which was growing at a rate of 7% per year. The country's main cement market was located on Java Island, which accounted for 60% of national consumption. Current consumption throughout the country stood at 39 Mt/yr and production capacity was 47 Mt/yr. PT Semen Gresik planned to increase its production capacity by 2.5 Mt/yr in 2010. Its subsidiaries PT Semen Tonasa in the Province of South Sulawesi and PT Semen Padang in the Province of West Sumatra each planned to increase their production capacities by 2.5 Mt/yr in

2010 and 2011, respectively. PT Semen Gresik also planned to build two new cement plants with a combined capacity of 5 Mt/yr at a cost of $670 million. Indocement Tunggal Prakarsa in the Province of South Kalimantan planned to raise its output by 2.5 Mt/yr, also in 2010 (Global Cement, 2008, p. 53).

Bosowa Corp. projected to spend $500 million in capital expenditure to finance its construction and cement projects for the next 3 years. Its cement plants produced more than 2 Mt/yr of cement combined. A new $300 million cement plant with a capacity of 2.5 Mt/yr would be developed on Java Island in 2009. PT Semen Gresik planned to increase its production capacity despite the increase in fuel (coal) prices. The company bought 70% of its coal from the spot market and 30% under long-term contract and was seeking additional coal supplies from major coal producers. PT Semen Gresik and its subsidiaries required 2.5 Mt/yr of coal. Indonesia's cement industry as a whole used 6 Mt/yr of coal (Global Cement, 2008. p. 54).

PT Holcim Indonesia, which was the third ranked cement producer in Indonesia, acquired PT Bintang Polindo Perkasa to strengthen its market presence on Java Island, particularly in Banten and West Java Provinces. PT Bintang Polindo Perkasa had a cement grinding plant with a production capacity of 600,000 t/yr (International Cement Review, 2008).

Diamond.—Gem Diamonds Ltd. would place its Cempaka alluvial diamond mine in the Province of South Kalimantan on care and maintenance status in 2009; the mine was a low margin operation. The deposits consisted of the Cempaka and the Danau Seran paleo-channels. Total indicated and inferred resources were estimated to be 87.2 Mt of gravel containing 2.6 million carats. The company was a leading supplier of high-quality rough diamond and produced white diamond and an array of colored diamond. In 2007, the company acquired BDI Mining, which held an 80% interest in the mine. Antam held the remaining 20% (Gem Diamonds Ltd., 2008).

Mineral Fuels

Coal.—A review of the drilling and exploration program at Churchill Mining plc of Australia's East Kutai coal project indicated an increase of 50% in the coal resource estimate to 150 Mt and a coal-bearing sequence of 16.5 km along strike. An intensive drilling program covered an area of 6 km by 2 km with 6,200 m of drilling in 3 months. As of June, about 9,000 m of drilling had been completed. The coal in the area was described as subbituminous with very low sulfur content and less than 5% ash. The energy content of the thermal coal was between 4,700 and 5,600 kilocalories per kilogram (kcal/kg). Trans Tek Engineering was responsible for the scoping study of the project with emphasis on the infrastructure and transportation requirements from the mine site to the port. Churchill Mining planned to bring East Kutai into production by the end of 2009 (Asia Miner, The, 2008c).

Indonesia produced 243 Mt of total coal compared with 232 Mt in 2007. About 75% of total coal output was exported. Domestic coal demand was expected to increase to 75 Mt in 2009 from 52 Mt in 2008. If the Government's cap on coal exports remained at 150 Mt/yr, coal consumption at this pace would exceed coal exports by 20 Mt between 2015 and 2020. The export limit was made in anticipation of the opening in 2010 of new coal-fired powerplants by PT Perusahaan Listrik Negara and the increasing use of coal instead of oil in the industrial sector. One of the new powerplants would be located at Suralaya in Cilegon in the Province of West Java; the plant would have a capacity of 652 MW (Coal Age, 2008).

Evergreen Energy Inc. of the United States and Sumitomo Corp. of Japan agreed with a major Indonesian coal company to proceed with the development of a feasibility study for a 1.36-Mt/yr K-Fuel™ coal refinery on Kalimantan Island. Kalimantan coal (lignite) worked well with the K-Fuel™ process. K-Fuel™ refined coal had 64% less moisture, 56% less mercury, and 52% more heat value (from 3,666 to 5,571 kcal/kg), which approached the performance level of bituminous coal. Indonesia had 4.5 billion metric tons of subbituminous and lignite coal reserves (Engineering and Mining Journal, 2008).

Natural Gas.—When British Petroleum plc's Tangguh LNG facility comes onstream, its gas was expected to meet both domestic and export requirements despite the decreasing output from the Arun and the Bontang plants. Tangguh would supply 7.4 Mt/yr of LNG. In 2007, LNG output from Arun and Bontang amounted to 21 Mt/yr. Indonesia remained one of the leading LNG exporters in the world. New gas supply would be needed to meet the increasing domestic demand (Petroleum Economist, 2008d).

Eni S.p.A. of Italy planned to build Indonesia's first floating LNG-production facility in the Bukat area in the Tarakan basin. In 2007, Eni discovered oil and gas in the Tulip Field in Bukat. Eni also discovered oil, which tested at more than 5,000 bbl/d in a nearby field in Bukat. Eni was developing the Aster Field with Anadarko Petroleum Corp. of the United States.

Petroleum.—Mature oilfields had made Indonesia a net importer of oil since 2004. The country imported oil from Iran, Kuwait, and Saudi Arabia. In 2007, Indonesia produced 910,000 bbl/d of oil mainly in northern Sumatra Island which was 40,000 bbl/d below its target. In 2008, it produced 978,000 bbl/d. The country decided to withdraw from its membership in the Organization of Petroleum Exporting Countries (OPEC) in January owing to its inability to meet the OPEC export quotas (British Broadcasting Co., 2008).

The Government planned to invite bids for 46 oil and gas blocks in 2008 through direct offer and regular tender. The Ministry of Energy awarded 22 offshore oil and gas blocks in October, and expected as a result to have 27 new exploration wells drilled and $330 million invested. U.S. companies Chevron Corp. (the West Papua I and West Papua III Blocks), ConocoPhillips Co. (the Arafura Sea Block), and Marathon Oil Corp. and its partner Kaizan Co. (the Bone Bay Block) were among the winners. The Ministry also awarded concessions for nine new blocks and expected investment of $465 million in the first 3 years. Hess Corp. of the United States won the Semai Block offshore the Province of West Papua. A consortium consisting of Inpex Corp. of Japan, PTT Public Company Ltd. of Thailand, and Murphy Oil Corp. of the United States won the nearby Semai II Block. Exxon Mobil Corp. of the United States won the Gunting Block in East Java Province (Petroleum Economist, 2008g).

ExxonMobil planned to spend $450 million exploring two blocks—the Mandar in Polewali Mandar Regency and the Surumana in Dongala Regency—in West Sulawesi Province. The blocks could have combined reserves of 1 billion barrels of oil equivalent. Drilling would start in December 2008 (Petroleum Economist, 2008e).

Australian Worldwide Exploration (AWE) started drilling for oil at the Bulu production-sharing contract (PSC) in the Java Sea. The Lisah-1 well was drilled 90 km north of Surabaya in East Java Province in 60 m of water. The Lengo-1 well would be drilled in the northwest corner of the Bulu PSC. Participants in the Bulu PSC were AWE (42.5%), Pearl Oil (Satria) Ltd. (42.5%), PT Satria Energindo (10%), and PT Satria Wijaya Kusuma (5%) (Asia Miner, The, 2008d).

PT Chevron Pacific Indonesia started producing oil from its North Duri Field Area 12 on the island of Sumatra. Output was expected to increase to 34,000 bbl/d of oil in 2012. Initial production would increase with the application of steamflood technology in 2009. Steamflooding was an enhanced oil recovery method that injected steam into the reservoir to increase oil recovery. The North Duri Area 12 was the latest expansion of the Duri Field, which produced nearly 200,000 bbl/d of oil (Rigzone.com, 2008).

State-owned Pertamina planned to take over operation of the West Madura Field offshore the Province of East Java and to increase its stake to more than 50% when the existing contract with its foreign partners expired in 2011. Kodeco Energy Co. Ltd. of the Republic of Korea was the operator and shared its 50% stake with China National Offshore Operating Co. The field produced 6,500 bbl/d of oil and 1,270 cubic meters per day of gas. Oil production was also expected to be below 10,000 bbl/d in 2009 (Petroleum Economist, 2008f).

National Iranian Oil Co. signed an agreement with Pertamina and a Malaysian company to build a 300,000-bbl/d oil refinery in Banten Province. In the first phase of the project, Pertamina would import 150,000 bbl/d of Iranian heavy crude oil for processing and sale in Asia. The remaining crude oil would come from Libya under a 20-year sales agreement. Indonesia had seven oil refineries with a total refining capacity of 1.05 million barrels per day (Petroleum Economist, 2008b).

Trans Pacific Petrochemical Indonesia would start producing 50,000 bbl/d of gasoline by buying 80,000 bbl/d of condensate at yearend. The output would be sold to Pertamina as part of a campaign to reduce the country's oil-import bill. The company was owned by Pertamina (15%), Tuban Petro (59.5%), Siam Cement of Thailand (17%), and Itochu Corp. and Sojitz Corp. of Japan (4.25% each) (Petroleum Economist, 2008c).

Outlook

Production of smelted copper is expected to increase owing to expanded capacity at Gresik and the introduction of two new copper smelters in the next 3 to 5 years. In addition to the existing aluminum smelter and steel plant, Indonesia is expected to set up a new smelter and a new plant, respectively, by joint ventures with foreign companies. With PT Tambang Timah switching from onshore mining of tin to offshore mining, in addition to PT Koba Tin's full production, Indonesia will likely remain the leading exporter of tin in Asia. Cement output is expected to increase by 15 Mt/yr when several cement companies either expand their production capacities or set up new cement plants in the next 2 to 3 years. The country's LNG production capacity is expected to increase by 7.4 Mt/yr from the current 21 Mt/yr with the commissioning of British Petroleum's Tangguh LNG plant and the planning of Eni's floating LNG plant. Indonesia is expected, therefore, to continue to be one of the leading exporters of LNG in the world.

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TABLE 1
INDONESIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
METALS						
Aluminum:						
Bauxite, wet basis, gross weight	thousand metric tons	1,331	1,442	1,502	1,251	1,152
Metal, primary		240,800 [r]	252,300	250,300	242,100 [r]	242,500
Chromite sand, dry basis[e]		1,000	1,000	1,000	1,000	1,000
Copper:						
Mine, Cu content		840,318	1,064,200	818,000	796,900	651,000
Metal:						
Smelter, primary		211,600	275,000	201,200	277,100 [r]	261,300
Refinery, primary		210,500	262,900	217,600	221,400	181,300
Gold, mine output, Au content[2]	kilograms	91,710	130,620	93,176	117,851	64,390
Iron and steel:						
Iron sand, dry basis		89,664	32,203	87,970	61,077	65,000 [e]
Metal:						
Ferroalloys:						
Ferronickel		39,538	36,690	72,300 [r]	92,500 [r]	95,000 [e]
Ferromanganese[e]		12,000	12,000	12,000	12,000	12,000
Silicomanganese[e]		7,000	4,000	5,000	6,000	7,000
Pig iron, direct-reduced iron	thousand metric tons	1,470	1,390	1,290	1,420 [r]	1,290
Steel, crude	do.	3,682	3,675	3,759	4,160 [r]	3,915
Steel, semimanufactured	do.	4,238	4,859	5,150	5,400 [e]	5,200 [e]
Nickel:						
Mine output, Ni content[3]		136,000	135,000	157,200	229,200	192,600
Matte, Ni content		81,120	77,471	72,782	77,928	73,356
Ferronickel, Ni content		7,945	7,003	7,572	9,498	9,003
Silver, mine output, Ag content	kilograms	261,960	320,590	261,398	268,967	226,051
Tin:						
Mine output, Sn content		65,772	78,404	80,933	66,137	53,228
Metal[4]		49,872	65,300	65,357	64,127	53,471
Zirconium concentrates, gross weight		500	2,600	65,000	111,000	65,000 [e]
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	33,230	33,917	35,000 [e]	36,000 [e]	37,000 [e]
Clays:[e]						
Bentonite		5,000	5,000	5,500	5,500	6,000
Fire clay	thousand metric tons	1,900	2,000	2,000	2,100	2,100
Kaolin powder		15,000	15,000	15,000	15,000	15,000
Diamond:[e]						
Industrial stones	thousand carats	23	23	23	23	28
Gem	do.	7	7	7	7	7
Total	do.	30	30	30	30	35
Feldspar[e]		24,000	24,000	25,000	25,000	26,000
Gypsum[e]		6,000	6,000	6,000	6,000	6,000
Iodine[e]		75	75	75	75	75
Nitrogen, N content of ammonia[e]	thousand metric tons	4,120 [5]	4,400	4,300	4,400	4,500
Phosphate rock[e]		600	600	600	600	600
Salt, all types[e]	thousand metric tons	680	680	700	700	700
Stone:						
Dolomite[e]		3,100	3,100	3,200	3,200	3,300
Granite[e]	thousand metric tons	3,340 [5]	4,170 [5]	4,200	4,300	4,400
Limestone[e]	cubic meters	16,000	16,500	16,000	17,000	18,000
Marble[e]	do.	1,000	1,000	1,000	1,000	1,000
Quartz sand and silica stone[e]	do.	132,000 [r]	132,000 [r]	135,000 [r]	135,000 [r]	138,000
Sulfur, elemental[e]		3,500 [r]	3,500 [r]	3,500 [r]	3,500 [r]	3,500
Zeolite[e]		400	400	400	400	400

See footnotes at end of table.

TABLE 1—Continued

INDONESIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Anthracite[e]		50,000	50,000	52,000	53,000	54,000
Bituminous	thousand metric tons	131,530	142,920	181,061	178,791 [r]	188,717
Gas, natural:						
Gross	million cubic meters	83,740	85,830	102,300	79,410 [r]	81,842
Marketed[e]	do.	52,000	53,000	52,000	76,664 [r, 5]	78,985 [5]
Petroleum, crude including condensate	thousand 42-gallon barrels	362,000	352,000	367,000	305,000 [r]	311,000

[e] Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r] Revised. do. Ditto.

[1] Table includes data available through September 14, 2009.

[2] Includes Au content of copper ore and output by Government-controlled foreign contractors' operations. Gold output by operators of so-called people's mines and illegal small-scale mines is not available but may be as much as 20 metric tons per year.

[3] Includes a small amount of cobalt that was not recovered separately.

[4] Output by Central Government-controlled foreign contractor operations. Tin output from small tin smelters is not available but may be as much as 40,000 metric tons per year.

[5] Reported figure.

TABLE 2
INDONESIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Locations of main facilities	Annual capacity[e]
Aluminum:				
Bauxite		PT Antam Tbk (Government, 65%)	Kijang, Bintan Island, Riau	1,300
Metal		PT Indonesia Asahan Aluminum (Nippon Asahan Aluminum Co. Ltd., 59%, and Government, 41%)	Kual Tanjun, North Sumatra	250
Cement		PT Indocement Tunggal Prakarsa Tbk	Cirebon and Citeureup, West Java; Tarjun, South Kalimantan	15,600
Do.		PT Semen Andalas Indonesia	Aceh Besar	1,400
Do.		PT Semen Baturaja (Persero)	Baturaja-Ogan Komering Ulu, South Sumatra	1,250
Do.		PT Semen Bosowa Maros	Kabupaten Maros, Sulawesi Selatan	1,800
Do.		PT Holcim Tbk (former known as PT Semen Cibinong)	Narogong, East Java	9,700
Do.		PT Semen Gresik (Persero) Tbk	Gresik and Tubar, East Java	8,200
Do.		PT Semen Padang (Persero)	West Sumatra	5,440
Do.		PT Semen Tonasa (Persero)	Pangkep, Sulawesi Selatan	3,480
Coal		PT Adaro Indonesia (New Hope Corp, 50%; PT Asminco Bara Utama, 40%; Mission Energy, 10%)	Paringin and Tutupan, South Kalimantan	35,000
Do.		PT Arutmin Indonesia (PT Bumi Resources Tbk, 80%, and Bakrie Group, 20%)	Mulia, Senakin, and Satui, South Kalimantan Asam-Asam, East Kalimantan	20,000
Do.		PT Berau Coal (PT United Tractor, 60%; PT Armadian, 30%; Nissho Iwai, 10%)	Berau, East Kalimantan	13,000
Do.		PT Kaltim Prima Coal Co. (PT Bumi Resources Tbk, 100%)	East Kutai Regency, East Kalimantan	36,000
Do.		PT Kideco Jaya Agung (Samtan Co. Ltd., 100%)	Pasir, East Kalimantan	12,000
Do.		PT Tambang Batubara Bukit Asam (state owned)	Tanjung Enim and Ombilin, South Sumatra	19,000
Copper:				
Concentrate		PT Freeport Indonesia Co. (Freeport-McMoRan Copper & Gold Inc., 81.28%; Government, 9.36%; others, 9.36%)	Ertsberg and Grasberg, Papua	800
Do.		PT Newmont Nusa Tenggara (Newmont Gold Mining Co., 45%; Sumitomo Corp., 35%; PT Pukuafu Indah, 20%)	Sumbawa Island, West Nusa Tenggara	300
Metal		PT Smelting Co. (Mitsubishi Materials Corp., 60.5%; PT Freeport Indonesia Co., 25%; others, 14.5%)	Gresik, East Java	210
Gas:				
Natural	millon cubic feet per day	ExxonMobil Oil Indonesia	Arun and Aceh, North Sumatra	1,700
Do.	do.	Roy M. Huffington (subsidiary of HUFFCO Group)	Badak, East Kalimantan	1,000
Do.	do.	Total Indonesie	Offshore, East Kalimantan	2,100
Liquefied		PT Arun LNG Co. Ltd. (Government, 55%; Mobil Oil Co., 30%; Japan Indonesia LNG Co., 15%)	Balang Lancang amd Aceh, North Sumatra	12,500
Do.		PT Badak LNG Co. Ltd. (Government, 55%; HUFFCO Group, 30%; Japan Indonesia LNG Co., 15%)	Bontang, East Kalimantan	22,500
Gold	metric tons	Aurora Gold Ltd. (100%)	Balikpapan, Central Kalimantan	60
Do.	do.	PT Antam Tbk (Government, 65%)	Bogor, West Java	3
Do.	do.	PT Freeport Indonesia Co. (Freeport-McMoRan Copper & Gold Inc., 81.28%; Government, 9.36%; others, 9.36%)	Ertsberg and Grasberg, Papua	110
Do.	do.	PT Newmont Nusa Tenggara (Newmont Gold Mining Co., 45%; Sumitomo Corp., 35%; PT Pukuafu Indah, 20%)	Sumbawa Island, West Nusa Tenggara	16
Do.	do.	PT Nusa Halmahera (PT Aneka Tambang Tbk, 17.5%, and PT Newcrest Mining Ltd., 82.5%)	Halmahera Island, Maluku	24
Do.	do.	PT Prima Lirang Mining (Billiton BV, 90%, and PT Prima Maluku Indah, 10%)	Lerokis, Wetar Island	3
Nickel:				
In ore		PT Antam Tbk (Government, 65%)	Pomalaa, South Sulawesi and on Gebe Island	80
Do.		PT International Nickel Indonesia Tbk (Inco Ltd., 59%; Sumitomo Metal Mining Co. Ltd., 20%; others, 21%)	Soroako, South Sulawesi	70
In matte		PT Antam Tbk (Government, 65%)	Pomalaa, South Sulawesi	24
Do.		PT International Nickel Indonesia (Inco Ltd., 59%; Sumitomo Metal Mining Co. Ltd., 20%; others, 21%)	Soroako, South Sulawesi	68

See footnotes at end of table.

TABLE 2—Continued
INDONESIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Locations of main facilities	Annual capacity[e]
Nitrogen	PT Aseah-Aech Fertilizer (Government, 60%, and other members of the Association of Southeast Asian Nations, 40%)	Lhokseumawe, North Sumatra	506
Do.	PT Pupuk Iskandar Muda (Government, 100%)	do.	506
Do.	PT Pupuk Kalimantan Timur (Government, 100%)	Bontang, East Kalimantan	1,010
Do.	PT Pupuk Kujang	Cikampek, West Java	330
Do.	PT Pupuk Sriwijawa (Government, 100%)	Palembang, South Sumatra	1,440
Petroleum, crude thousand barrels per day	Atlantic Richfield Indonesia, Inc. (subsidiary of Arco Co.)	Arjuna and Arimbi, offshore West Java	170
Do. do.	China National Offshore Oil Co.	Off of southeast Sumatra	100
Do. do.	Maxus Southeast Asia Ltd. (subsidiary of Maxus Energy)	Cinta and Rama, offshore Southeast Sumatra	95
Do. do.	P.T. Pertamina (Government, 100%)	Jatibarang, West Java, and Bunyu, offshore East Kalimantan	80
Do. do.	PT Caltex Pacific Indonesia (Texaco Inc., 50%, and Chevron Corp., 50%)	Minas, Duri, and Bangko, central Sumatra	700
Do. do.	Total Indonesie (subsidiary of Compagnie Francaise des Petroles of France)	Handi and Bakapai onshore and offshore East Kalimantan	180
Petroleum, refined do.	P.T. Pertamina (Government, 100%)	6 various locations	1,047
Silver	PT Antam Tbk (Government, 65%)	Bogor, West Java	25
Do.	PT Freeport Indonesia Co. (Freeport-McMoRan Copper & Gold Inc., 81.28%; Government, 9.36%; others, 9.36%)	Ertsberg and Grasberg, Papua	220
Do.	PT Kelian Equatorial Mining (Rio Tinto Group, 90%, and PT Harita Jaya Raya, 10%)	180 kilometers west of Samarinda	10
Steel, crude	PT Ispat Indo	Sidoarjo, Surabaya	700
Do.	PT Krakatau Steel (Government, 100%)	Cilegon, West Java	2,400
Do.	PT Komatsu Indonesia Tbk	Jakarta	8
Do.	PT Wahana Garuda Lestari	Pulogadung, Jakarta	410
Tin:			
In ore	PT Koba Tin (Malaysia Smelting Corp., 75%, and PT Tambang Timah Tbk, 25%)	Koba, Bangka Island	25
Do.	PT Tambang Timah Tbk (Government, 65%)	Onshore and offshore islands of Bangka, Belitung, and Singkep	60
Metal	Mentok Tin Smelter (PT Tambang Timah Tbk)	Mentok, Bangka Island, South Sumatra	68
Do.	Koba Tin Smelter (PT Koba Tin)	Koba, Bangka Island, South Sumatra	25

[e] Estimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto.

THE MINERAL INDUSTRY OF JAPAN

By Chin S. Kuo

Japan is an industrialized developed country whose free-market economy was the world's second largest after the United States. In 2008, the country's gross domestic product was valued at $4.4 trillion based on purchasing power parity, which was an increase of 1.4% compared with that of 2007. Japan has few mineral resources, and it imported raw materials and energy for its industrial production and use. Indigenous deposits of gold, magnesium, and silver partially met domestic demand whereas all bauxite, coke, copper, and iron ore and other mineral commodities had to be imported. The country imported significant amounts of crude oil and natural gas. The metals and metal products industries, which dominated the mineral sector of Japan, were a major producer and a primary exporter to the world metals market (International Monetary Fund, 2009).

Minerals in the National Economy

Japan's industries relied on imported minerals for its economic growth and used a large amount of nonferrous metals. As a result, the country was one of the world's major importers and consumers of most mineral commodities. Japan also was one of the world's major producers and exporters of fabricated metal and mineral products.

Although the mineral industry played an important role in supplying the industrial raw materials to Japan's manufacturing and construction industries, the mining industry was the smallest sector of the country's industrial structure. Operating mines and employment in the mining industry have been in decline because of depleted ore reserves, high mining costs, and the availability of cheaper imports. The mineral processing industry was large and included processing of chemicals, fabricated metal products, industrial mineral products, iron and steel, nonferrous metals, petroleum, and petroleum products.

Government Policies and Programs

To secure a stable supply of oil and natural gas, nonferrous metals, and mineral resources, state-owned Japan Oil, Gas and Metals National Corp. (JOGMEC) signed a memorandum of understanding (MOU) with Vale S.A. of Brazil to enhance their mutual cooperation as strategic partners. The MOU focused on technology development for exploration in Africa of such mineral resources as coal, copper, diamond, iron ore, manganese, nickel, platinum-group metals, and zinc. Japanese techniques of remote sensing analysis would be used to improve basic geologic information in the Southern African Development Community region (International Mining, 2008b).

In 2008, the Government gave JOGMEC nearly 50% more money than it had in 2007 towards JOMEC's metals exploration budget of $42 million to increase exploration expenditure in rare metals and uranium. The company engaged in joint-venture projects in which it provided exploration expertise and financing and acquired an equity stake that was transferred to a Japanese mining and metal company. In 2007 (the latest year for which data were available), JOGMEC had a combined total of 22 projects in the regions of Africa, Asia and the Pacific, Canada, and Latin America. In 2008, it provided $4.5 million for 3 years to Southern Gold Ltd. of Australia to explore for copper and zinc in Cambodia, with an option to take a 51% stake in the Australian mining company. The company's bacteria-leaching processing technology, when it becomes feasible, could treat low-grade copper ore, so JOGMEC also began financing exploration for such deposits as well (Tradingmarkets.com, 2008a).

The Japanese Government decided to impose an antidumping duty on imports of electrolytic manganese dioxide (EMD) from Australia, China, South Africa, and Spain. The antidumping duty became effective on September 1, 2008, and was to last for a period of 5 years. The rates were 46.5% for imports of EMD from China; 29.3% (Australia); 14.5% (South Africa); and 14% (Spain). EMD is used in Japan mainly to manufacture dry-cell batteries (Ministry of Economy, Trade and Industry, 2008b).

A revision of the Building Standards Law designed to tighten building safety triggered a slump in demand for cement owing to delays in the issuance of building permits. Japan's cement industry consisted of 18 cement companies and 32 cement plants with a production capacity of 71 million metric tons per year (Mt/yr) of clinker cement. In 2008, cement production decreased by 7.2% to 62.8 million metric tons (Mt) (Japan Cement Association, 2008).

Production

Japan produced a variety of mined metals and industrial minerals in addition to its processed metal and mineral products, which included cement, fertilizers, and crude steel. The industrial minerals that were mined included dolomite, feldspar, fire clay, limestone, pyrophyllite, silica sand, and silica stones. Owing to strong domestic demand in 2008, output and imports of refined cadmium metal increased by 9.6% and 18.5%, respectively, compared with those of 2007. Gold mine production declined by 31% as did primary gold metal output. Production of titanium dioxide decreased by 8.4% in 2008; the decrease was attributable to increased substitution of imports in domestic consumption. The quarrying industry cut back production because of low demand for crushed stone. Hydraulic cement production decreased by 7.2% compared with that of 2007. Production of dolomite and limestone decreased by 7.8% and 5.5% whereas that of silica sand and silica stone decreased by 15.1% and 12.9%, respectively. Japan produced small amounts of crude petroleum and natural gas, production of which increased by 2.6% and 0.7%, respectively, in 2008. Sulfur output as a byproduct of oil refining increased by 3.5% (table 1).

Structure of the Mineral Industry

Japan's mineral industry is characterized by small-scale, low-tonnage mining operations and high-value-added mineral and metal processing and manufacturing activities. Its mining industry is not significant to the economy because the country consumes more minerals and metals than it produces. Sumitomo Metal Mining Co. Ltd. (SMM) continued to operate the Hishikari gold mine in Kagoshima Prefecture. Mining and quarrying of industrial minerals was still being done but at a lower level of production than in previous years. However, Japan had a world-class metallurgical industry for nonferrous metals. To secure mineral resources to meet domestic demand, the Government's mineral policies included promotion of overseas exploration and materials recycling, buildup of a stockpile of rare metals, and technological development of essential metals and minerals (table 2; Sumitomo Metal Mining Co. Ltd., 2009).

Mineral Trade

Japan exported 37.67 Mt of iron and steel products in 2008, which was an increase of 3.5% compared with exports in 2007. The Republic of Korea was the leading destination followed by China, Thailand, and Taiwan. The country imported 7.58 Mt of iron and steel products, which was a decrease of 8.4% compared with imports of 2007, and the leading country of origin was the Republic of Korea followed by China and Taiwan. Japan produced 247,000 metric tons (t) of ferronickel with 24% nickel content and exported 543 t to the United States. In 2008, Japan imported 100% of its copper concentrate requirement of 1.317 Mt, 99.8% of its lead concentrate requirement of 110,000 t, and 98.7% of zinc concentrate requirement of 620,000 t.

The country imported the majority of its copper concentrate from Chile (46.3%) followed by Peru (13.9%), Indonesia (13.5%), and Canada (10.3%). Imports of lead concentrates came mainly from Australia (46.2%), the United States (33%), and Bolivia (13.6%). Japan's requirement for zinc concentrate was met by imports mainly from Peru (30.4%), Australia (26.7%), Bolivia (14.6%), and the United States (13.4%).

In 2008, Japan's production and imports of refined lead increased by 2.5% whereas consumption and exports decreased by 4.5%, which resulted in a stock buildup of 55.6% during the year. For refined lead, the apparent consumption decreased to about 216,000 t and the reported consumption decreased to 211,000 t in 2008. Output of refined zinc increased by 3% and imports of refined zinc decreased by 14.8%, which resulted in a decrease in the total supply. Exports of refined zinc increased by 13.9% and reported consumption decreased by 7.7%, which resulted in a decrease in total demand. As a result, stocks at yearend increased by 15.2% (table 3; Japan Mining Industry Association, 2009).

Commodity Review

Metals

Cobalt.—SMM planned to increase production of cobalt by 80% in 2009 from the 2008 output of 1,071 t to meet growing demand. The company's nickel refinery at Niihama in Ehime Prefecture would separate cobalt from intermediate nickel raw materials from Coral Bay Nickel Corp. in the Philippines and would have the capacity to produce 1,800 metric tons per year (t/yr) of cobalt. Cobalt was used primarily in lithium ion batteries. Global demand for cobalt was estimated to be between 55,000 and 60,000 t/yr and was growing at a rate of 5% to 10% per year. Japan was the leading consumer of cobalt and accounted for 25% of the world's total consumption (Tradingmarkets.com, 2008b).

Copper.—Japan produced 1.625 Mt of smelted copper and 1.540 Mt of refined copper in 2008 from imported copper concentrate (mainly from Canada, Chile, Indonesia, and Peru) and secondary materials. Of the smelted copper output, primary sources (concentrate and blister) accounted for 84% of the feedstock, and scrap accounted for 16%. Of the refined copper output, imported ore accounted for 86%; scrap, 7%; and other, 7%. The country imported 90,470 t of refined copper and exported 423,455 t. Refined copper was used in wire (61%), brass (36%), and other miscellaneous (2%) (Japan Mining Industry Association, 2009).

To secure stable and long-term supplies of copper concentrate, Mitsubishi Materials Corp. (MMC) and Copper Mountain Mining Corp. of Canada signed an MOU to redevelop the Similco copper mine near Princeton in the Province of British Columbia, Canada. The mine halted its production in 1996 and was to be restarted in the first quarter of 2011. MMC agreed to buy the newly issued shares of Similco Mines Ltd. to acquire a 25% equity interest and to arrange a $250 million loan. In return, MMC would purchase all production of 150,000 t/yr of copper concentrate during the mine's life. MMC also was invested in Huckleberry copper mine in Canada (Mitsubishi Materials Corp., 2008).

Pan Pacific Copper Co., Ltd. conducted a prefeasibility study of the mining concession of the Caserones copper deposit in Chile. The result called for combined production of copper and molybdenum concentrates and refined copper through the solvent extraction-electrowinning process. The project was estimated to have 26 years of mine life and was projected to produce 150,000 t/yr of copper and 75,000 t/yr of molybdenum starting sometime in 2012 with an investment of $1.7 billion. The copper concentrate would be shipped to Pan Pacific's smelters in Japan. The company also planned to conduct a prefeasibility study of the Quechua copper deposit in Peru (Pan Pacific Copper Co., Ltd., 2008).

Antofagasta plc of Chile agreed to sell a 30% interest in its Esperanza copper project and Tesoro copper mine in Chile to Marubeni Corp. for $1.31 billion. Marubeni would be responsible for its share of the development costs for Esperanza in return for a certain annual quantity of concentrate to be shipped to Japan for processing. The deal was subject to receipt of environmental approvals and to Antofagasta acquiring the Tesoro North East deposit, which was needed to extend the life of the Tesoro Mine. Esperanza was designed to produce 700,000 t/yr of concentrate containing an estimated 195,000 t of copper, 7,100 kilograms (kg) of gold, and 47 t of silver. First production was expected in 2011. Tesoro produced 93,000 t of copper cathode in 2007 (Mining Journal, 2008a).

Nippon Mining & Metals Co., Ltd. changed the name of its subsidiary Nikko Woojin Precision Manufacturing (Suzhou) Co., Ltd. in China to Nippon Mining & Metals (Suzhou) Co., Ltd. in January 2008. Nikko Woojin Precision Manufacturing (Suzhou) was established in 2003 as a joint venture with Woojin Precision Industry Co., Ltd. of the Republic of Korea. Nippon Mining & Metals (Suzhou) planned to start surface treatment operations, establish integrated rolling operations, and manufacture copper and copper alloy products in the field of precision fabrication (Nippon Mining & Metals Co., Ltd., 2008a).

Gold and Silver.—Japan produced 6,868 kg of mined gold in 2008, which was a 23% decrease from that produced in 2007. Refined gold output was 124,832 kg, a decrease of 20%, which was produced from imported ore (57%), scrap (14%), domestic ore (8%), and others (21%). The country produced 2,042,600 kg of primary refined silver, of which 58% came from imported ore, 13% from scrap, 0.6% from domestic ore, and 28% from other sources. Japan imported 2,098,400 kg of silver metal and exported 1,978,400 kg. Silver was used in photographic materials (37%), nitrate for other uses (12%), point connectors and extension materials (11% each), and other miscellaneous (29%) (Japan Mining Industry Association, 2009).

Mitsui Mining and Smelting Co., Ltd. planned to start production in 2011 of its new, less costly silver-based catalysts, which are coated with silver rather than the more-expensive platinum, for use in diesel particulate filters because they have comparable ability to remove soot from diesel exhausts and would cut metal costs by 90%. Oxidation catalysts, however, would continue to be platinum-based. The company's plan for silver and gold production was 213 t and 12.7 t, respectively, in fiscal year 2008-09 (Miningmx.com, 2008).

Iron Ore and Iron and Steel.—To secure a steady supply of iron ore from abroad, Japanese companies acquired stakes in joint ventures. Grange Resources Ltd. of Australia agreed to sell a 30% stake in the eastern extension of the Southdown magnetite deposit in Western Australia to Sojitz Resources and Technology Pty. Ltd. The eastern extension of the deposit was expected to supply iron ore for magnetite concentrate and pellet production. The sale agreement would increase Grange's royalty payment from Sojitz's 30% share of production (Asia Miner, The, 2008).

As iron ore prices rose in 2008, a number of Japanese steel companies, including JFE Steel Corp., Kobe Steel Ltd., Nisshin Steel Co. Ltd., and Sumitomo Metal Industries, Ltd. (Sumitomo Metals), negotiated agreements with Vale for a 65% increase in the contract price of iron ore fines. Earlier, Nippon Steel Corp. and Vale reached agreement on the contract prices for Carajas fines and Itabira fines. Japan relied on imports of iron ore to meet the requirements of its iron and steel industry (International Mining, 2008a).

A consortium consisting of Itochu Corp., Pohang Iron and Steel Co. Ltd. (POSCO), and five Japanese steel producers (JFE Steel, Kobe Steel, Nippon Steel, Nisshin Steel, and Sumitomo Metals) reached an agreement with Companhia Siderurgica Nacional of Brazil to acquire a 40% interest in its iron ore mining and sales subsidiary Nacional Minerios S.A. (NAMISA) for $3.12 billion. NAMISA operated an iron ore project through its mines and beneficiation plants and planned to sell 18 Mt/yr of iron ore in 2009 and to increase sales to 38 Mt/yr through expansion. The five Japanese steel companies and POSCO were expected to enter into long-term iron ore purchase agreements with NAMISA (JFE Steel Corp., 2008a).

JFE Steel (40%) and Foulath of Bahrain (60%) signed an MOU to establish a $700 million pelletizing plant in Oman that would produce iron ore pellets. JFE Steel would receive 3.5 Mt/yr on a long-term basis (25 years) out of a production capacity of 7 Mt/yr. The remaining 3.5 Mt/yr would be sold to direct-reduced iron and other blast furnace plants in the Middle East and Asia. The pelletizing plant was expected to be operational in 2011 (JFE Steel Corp., 2008b).

In 2008, Nippon Steel reported a 4-Mt decrease in steel production compared with the 33 Mt produced in 2007 owing to decreased demand from automobile makers. The company planned to suspend the operation of a blast furnace at its Oita plant in Oita Prefecture in February 2009 to perform maintenance and would restart operations there in May. ArcelorMittal, JFE Steel, and POSCO also planned to cut steel production (BBC News, 2009).

Sumitomo Metals started the brickwork building of its new No. 1 blast furnace at the Wakayama Steel Works to replace the No. 4 blast furnace. Furnace construction work began in November 2006 and cost $450 million. The furnace had an inner volume of 3,700 cubic meters and a capacity of 7,500 metric tons per day; it was expected to be completed in July 2009 and to last 25 years. As a result, steel production at the Wakayama Works would be 4.5 Mt/yr. A new No. 2 blast furnace starting operation in October 2012 was planned to replace the No. 5 blast furnace. At that time, the production capacity at the works would be 5.2 Mt/yr of steel (Sumitomo Metal Industries, Ltd., 2008a).

The country produced 86.2 Mt of pig iron, which was slightly lower than the 86.8 Mt produced in 2007. Production of crude steel amounted to 118.7 Mt in 2008, which was a decrease of 1.2% from that of 2007. Japan was the second ranked producer of crude steel after China, and Japan's Nippon Steel was ranked second after ArcelorMittal in steel output in the world. The country's output of stainless steel was 3.210 Mt, of which 1.657 Mt was nickel-based and 1.553 Mt was chrome-based (World Steel Association, 2009).

Lead and Zinc.—In 2008, Japan's production of refined (primary and secondary, but not remelted) lead and refined zinc amounted to 224,900 t and 615,500 t, respectively. Of these amounts, Mitsui Mining and Smelting produced 59.6 t and 244.5 t, respectively. The country imported 110,000 t of lead in concentrate mainly from Australia, Bolivia, and the United States and 620,000 t of zinc in concentrate mainly from Australia, Bolivia, Peru, and the United States. Of the refined lead output, imported ore accounted for 47%; scrap, 36%; and other, 17%. Japan imported 25,500 t of refined lead and exported 26,200 t. Refined lead was used in batteries (90%), chemicals (3%), solder (2%), and other miscellaneous (3%). Production of remelted lead was 53,200 t. The country imported 1,500 t of remelted lead and exported 12,300 t. Remelted lead was used in batteries (77%) and recycling (19%). Of the refined zinc output, imported ore accounted for 82%; domestic ore, 1%; scrap, 0.3%; and other, 17%. The country imported 45,300 t of refined zinc and exported 84,500 t. Refined zinc was used in galvanized sheet (46%), other galvanizing (19%), brass (13%), die casting alloy (11%), chemicals (7%), and other miscellaneous (3%). Production of remelted zinc was 31,900 t. Japan imported 865 t of remelted zinc and exported 19,500 t. Remelted zinc was used in chemicals (26%), galvanized sheet (24%), brass (23%), other galvanizing (15%), and other miscellaneous (8%) (Japan Mining Industry Association, 2009).

Lithium.—SMM decided to establish Sumiko Kunitomi Electronics Co., Ltd. to take charge of the manufacturing of electronics and advanced materials, that was currently being done by SMM's Kunitomi District Division in Iwanai, Hokkaido Prefecture. The spinoff would be effective in April 2009. The Kunitomi District Division served as a production base for crystal materials, such as lithium niobate, lithium tantalite, and yttrium aluminum garnet, and magnetic materials, such as samarium iron nitride (Sumitomo Metal Mining Co. Ltd., 2008b).

Nickel.—Japan's total nickel production was 154,100 t, excluding nickel in chemicals, of which refined nickel was 34,900 t and nickel in ferronickel and nickel oxide was 119,200 t. The country produced 2,333 t of nickel in chemicals. The country's output of refined nickel increased by 15% whereas that of nickel in ferronickel and nickel oxide decreased by 7% owing to reduced supply of nickel ore from Société Minière du Sud Pacifique of New Caledonia.

SMM planned to boost nickel production by 14% in fiscal year 2008-09 by operating its Niihama refinery at full capacity to reach 41,000 t/yr of nickel. The company also intended to double the production capacity at its Coral Bay unit on Palawan Island in the Philippines, which produced nickel-cobalt mixed sulfide that was shipped to the Niihama plant. The Niihama refinery was expected to be shut down for 4 days in May and November 2008 for maintenance (Mining Journal, 2008d).

SMM revised the cost of construction of the high-pressure acid leach (HPAL) plant No. 2 at its subsidiary Coral Bay Nickel Corp. in the Philippines. The initial cost was projected to be $285 million but this amount was increased to $307 million owing to changes in the specifications of some of the facilities. The production capacity for plants No. 1 and No. 2 combined was expected to be 22,000 t/yr of nickel. Production was expected to begin in April 2009 (Sumitomo Metal Mining Co. Ltd., 2008a).

Titanium.—Sumitomo Metals planned to spin off its titanium sheet and plate business to its subsidiary Sumitomo Metals (Naoetsu), Ltd. As a result, Sumitomo Metals would report a decrease in its capital. Sumitomo Metals (Naoetsu) would assume the assets and liabilities related to the titanium sheet and plate sales, as well as the existing contracts and technical services (Sumitomo Metal Industries, Ltd., 2008b).

Industrial Minerals

Limestone.—Japan was self-sufficient in limestone output and produced 156.8 Mt of limestone in 2008. Nittetsu Mining Co., Ltd.'s subsidiary Funao Mining Co., Ltd. was mainly responsible for the mining and sales of limestone in the country. The company's Torigatayama Quarry Complex in Kochi Prefecture was the leading limestone mine in Japan in terms of output. The company's output of limestone was 23 Mt/yr and was supplied to domestic cement and steel producers. A portion of the production was exported to Australia. The company also produced 5 Mt/yr of limestone aggregates for the construction industry (Nittetsu Mining Co., Ltd., 2008).

Zeolites.—Tosoh Corp. planned to double its zeolite production and to increase zirconia (zirconium dioxide) powder output by 50% with an investment of $70.3 million. Plans called for construction of new plants for the production of high-silica synthetic zeolite and zirconia powder at its Yokkaichi Complex in Mie Prefecture. The project was expected to be completed in December 2008. High-silica synthetic zeolites were used as catalysts and absorbents in the petrochemical industry. Tosoh's other synthetic zeolite product was Zeolum, which was used as a molecular sieve for selective absorption in drying, purifying, and separating a variety of materials. The company's zirconia product line included powdered grade, compound, and machined component (Industrial Minerals, 2008).

Mineral Fuels and Related Materials

Coal.—Japan had produced limited amounts of coal since 2002, and some coal resources were being mined at several small mines in Hokkaido Prefecture. The country had to import steam coal for domestic use in cement and paper plants and for power generation, and coking coal for use by the steel industry. Coal accounted for 21% of the country's primary energy supply. Steam coal came from Australia, China, South Africa, and the United States, and coking coal was sourced from Australia, Canada, Russia, and the United States. Although Japan's coal reserves were estimated to be 360 Mt on Hokkaido and Kyushu Islands, they were too deep and costly to be mined (Methanetomarkets.org, 2009).

The Governments of Japan and Indonesia jointly inaugurated the upgraded brown coal project at the Satui coal mine in South Kalimantan Province in Indonesia. Low-rank coal with high moisture and low heat value was dewatered in oil so that it could be transformed into high-rank coal with a higher heat value of at least 6,500 kilocalories per kilogram of coal. In the future, operation data analysis and product evaluation tests using boilers would be performed with an aim at commercialization. Japan was considering importing this upgraded brown coal for its power sector (Ministry of Economy, Trade and Industry, 2008a).

Nippon Steel and Sumitomo Corp. raised their shares in Mitsui Mining Co. Ltd. from 12.9% each to 21.7% each in a bid to secure coking coal supplies. The deal would be worth $125 million each. Nippon Steel had already purchased 1 Mt of coke from Mitsui Mining to be delivered in 2008 (Mining Journal, 2008c). Nippon Steel, Vale, and other partners of the Carborough Downs joint venture would invest in the expansion of the underground operation at the Carborough Downs coal mine, which is located 150 km southwest of Mackay in Queensland, Australia. The production rate of the mine was expected to be 3.7 Mt/yr after 2009. Nippon Steel already held a 5% interest in the mine. The Carborough Downs Mine would be Nippon Steel's first coking coal project and would involve the installation of a new coke oven that would use low-grade coal because of its improved operational technology (Nippon Steel Corp., 2008).

Natural Gas.—Tokyo Gas Co. planned to build a fourth liquefied natural gas regasification terminal at Hitachi in Ibaraki Prefecture with an investment of $880 million. The receiving facilities included docks for tankers, storage tanks, and regasification equipment. The new terminal was scheduled to start operations in 2017. Tokyo Gas operated two terminals at Yokohama and one at Sodegauru in Chiba Prefecture. The company's industrial gas accounted for 40% of its gas sales and it supplied 50,000 t/yr of natural gas to Hitachi Ltd.'s powerplant in the region (Oil & Gas Journal, 2009).

Petroleum.—JOGMEC planned to sign an MOU with Petróleos de Venezuela S.A. to jointly explore for oil near the Orinoco River in Venezuela. The Orinoco extra-heavy oil deposits, which were tar-like and highly viscous, contained oil sands and oil shale. Japan was 90% dependent on the Middle East for its crude oil imports and was making efforts to strengthen its energy security through the diversification of crude oil suppliers, such as by investing in the unconventional oil deposits in Venezuela (Rigzone.com, 2008).

Nippon Oil Corp. agreed to merge with Nippon Mining Holdings Inc. to form a holding company that would engage in oil development and refining and mining operations for copper and other nonferrous metals. A final merger agreement would be signed by March 2009. The combined group was expected to rank among the world's 10 leading private-sector oil companies by revenue. Japan had 30% more refining capacity than it needed to satisfy domestic demand. As a result, the group's oil refining output would be reduced by 20%, or 400,000 barrels per day, in 2 years. The group would distribute one-third of Japan's petroleum products. The merger would allow the group to increase its investments in upstream oil and gas production and help it expand into the use of such alternative energy technologies as fuel cells and solar power (Financial Times, The, 2008).

Uranium.—Japan was looking for sources of uranium to meet its future requirements to generate nuclear energy. Marubeni Corp. signed a letter of intent with Khan Resources Inc. of Mongolia regarding exploration and mining of the Dornod uranium project in northeastern Mongolia. Marubeni would work to improve the mining investment climate in Mongolia, and Khan Resources would provide Marubeni with access to due diligence information on a confidential basis. Khan Resources had completed a prefeasibility study of its 69% owned project of Dornod. The Government of Mongolia might seek to increase its 21% interest in the project (Mining Journal, 2008b).

Recycling

To procure raw materials for recycling in Japan, Nippon Mining & Metals and its affiliated companies restructured and consolidated their operations in Taiwan in electronic materials and metal manufacturing and trading, and established Nikko Metals Taiwan Co. Ltd. to collect and pre-treat copper and precious metal-bearing scrap in Taiwan. Nippon Mining & Metals also was engaged in the expansion and development of its recycling and environmental services, including promotion of its Hitachi Metal Recycling Complex project. The first phase of construction was completed on schedule. The completed facility would recover nickel and tin (500 t/yr each), bismuth (200 t/yr), antimony (150 t/yr), and other metals from intermediate products generated during the smelting and refining process at the Saganoseki smelter and refinery, and recycled materials treated through the pyro-metallurgical process of Nikko Environmental Service. The second-phase facility would produce zinc (700 t/yr), indium (6 t/yr), and other metals, and the third-phase facility would recover copper (6,000 t/yr), precious metals [gold, 500 kilograms per year (kg/yr); silver, 50 t/yr; and platinum, 200 kg/yr], and others (Nippon Mining & Metals Co., Ltd., 2008b).

Reserves and Resources

Japan has large reserves of industrial minerals, including dolomite, iodine, limestone, pyrophyllite, silica sand, and silica stones. Limestone is the most abundant indigenous mineral resource. Its reserves of nonferrous metals, such as lead, silver, and zinc, are small with the exception of gold, deposits of which had been found and were being mined on a small scale in Kagoshima Prefecture on Kyushu Island. Japan's reserves of gas and oil are negligible (table 4).

Outlook

Japan is a resource-poor country and depends on mineral imports to supply its manufacturing industry. Japan is expected to remain an important player in international mining because of the investments its mining and trading companies are making to secure the importation of ores and concentrates for the smelting, refining, and fabricating industries; coal for powerplants; and end-use metals for the manufacturing industries.

Japan's mine production is expected to decrease in the next 2 to 3 years for some nonferrous metals owing to the depletion of ore reserves. Mine output of lead and zinc has ceased following the closure of the Toyoha Mine in 2006. Only gold and silver are being mined. In the aluminum industry, demand and exports for aluminum semifabricated products (rolled and extrusions) are expected to decrease owing to slumps in the automotive and construction sectors caused by the global recession. In the iron and steel industry, production of ferroalloys, pig iron, and steel is expected to remain at the same level of output because of the slightly weaker demand on the domestic market. Output of cement is expected to decline owing to the Government's cutback in spending for public works and the construction downturn.

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TABLE 1
JAPAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
METALS						
Aluminum:						
Alumina[e]	thousand metric tons	380	350	330	300	320
Aluminum hydroxide[e]	do.	750	740	720	700	700
Metal:						
Primary:						
Regular grades	do.	6	7	7	6	7
High-purity	do.	55	45	50	51	51
Secondary[2]	do.	1,015	1,039	1,070	1,100 [e]	1,100 [e]
Antimony:						
Oxide		8,716	7,792	7,778	7,939	6,954
Metal		222	253	275	270	325
Arsenic, trioxide[e]		40	40	40	40	40
Bismuth		522	463	425	408	410 [e]
Cadmium, refined		2,233	2,297	2,286	1,939	2,126
Chromium, metal[e]		1,600	700	700	500	600
Cobalt, metal		421	471	920	1,084	1,071
Copper, metal:						
Blister and anode:						
Primary		1,270,495	1,319,247	1,409,087	1,367,310	1,366,310
Secondary		194,927	198,516	219,203	245,208	259,060
Total		1,465,422	1,517,763	1,628,290	1,612,518	1,625,370
Refined:						
Primary		1,188,491	1,227,528	1,342,350	1,369,814	1,328,157
Secondary		191,653	167,756	189,705	207,004	211,681
Total		1,380,144	1,395,284	1,532,055	1,576,818	1,539,838
Gallium, metal:						
Primary[e]		9	10	8	8	7
Secondary		78	86	93	90 [e]	85 [e]
Germanium:						
Oxide[e]		50	50	50	50	50
Metal, polycrystal	kilograms	943	1,731	1,682	1,700 [e]	1,720 [e]
Gold:						
Mine output, Au content	do.	8,021	8,318	8,904	8,869	6,868
Metal:						
Primary	do.	136,616	146,182	144,164	117,529	81,399
Secondary[3]	do.	23,183	23,710	23,952	38,331	43,433
Total	do.	159,799	169,892	168,116	155,860	124,832
Indium, metal[e]	do.	70,000	70,000	55,000 [r]	60,000 [r]	65,000
Iron and steel, metal:						
Pig iron	thousand metric tons	82,974	83,058	84,270	86,771	86,171
Electric-furnace ferroalloys:						
Ferrochrome		13,472	12,367	13,056	12,016	13,888
Ferromanganese		437,389	448,616	406,162	420,151	431,181
Ferronickel		374,213	391,074	335,884	351,503	301,361
Silicomanganese		73,041	94,725	59,424	52,901	58,884
Ferromolybdenum		3,323	4,019	4,229	4,573	4,554
Ferrovanadium		2,178	2,360	2,042	3,205	3,477
Unspecified		7,321	10,057	13,123	13,982	14,478
Total		910,937	963,218	833,920	858,331	827,823
Steel, crude	thousand metric tons	112,718	112,471	116,226	120,203	118,739
Semimanufactures, hot-rolled:						
Ordinary steels	do.	83,354	80,828	83,139	86,704	88,000 [e]
Special steels	do.	19,843	20,360	20,982	21,498	23,000 [e]

See footnotes at end of table.

TABLE 1—Continued
JAPAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
METALS—Continued						
Lead:						
Mine output, Pb content		5,512	3,437	777	--	--
Metal, refined:						
Primary		94,272	106,638	108,271	104,527	107,005
Secondary including remelted		188,603	167,980	171,743	171,795	172,454
Total		282,875	274,618	280,014	276,322	279,459
Magnesium, metal, secondary[e]		10,000	11,000	12,000	12,000	13,000
Manganese, oxide[e]		45,680 [4]	45,500	45,500	45,000	45,000
Molybdenum, metal		812	901	1,253	1,172	1,241
Nickel metal:						
Refined		32,729	29,399	29,254	30,402	34,861
Ni content of nickel oxide sinter		60,300	56,700	53,800	60,151 [r]	60,000 [e]
Ni content of ferronickel		73,655	76,390	66,058	68,346	59,259
Ni content of chemical		2,082	2,208	2,531	2,270	2,333
Total		168,766	164,697	151,643	161,169 [r]	156,000 [e]
Platinum-group metals:[e]						
Palladium, metal	kilograms	5,300	5,400	5,400	5,500 [r]	5,500
Platinum, metal	do.	750	760	760	770 [r]	770
Rare-earth oxides[4]		6,015	6,432	8,243	8,561	8,435
Selenium, metal		599	625	730	806	754
Silicon, multicrystalline		6,135	6,923	6,987	7,364	7,471
Silver:						
Mine output, Ag content	kilograms	75,689	54,098	11,463	5,300 [r]	5,000 [e]
Metal:						
Primary	do.	2,208,270	2,202,794	2,253,203	2,263,009	2,042,604
Secondary[3]	do.	219,047	192,177	228,000	391,869	253,374
Total	do.	2,427,317	2,394,971	2,481,203	2,654,878	2,295,978
Tantalum, metal[e]		95	95	95	95	95
Tellurium, metal		33	34 [r]	35 [r]	41 [r]	40 [e]
Tin, metal, smelter		707	754	854	879	956
Titanium:						
Dioxide		253,364	259,015	239,916	245,976	225,228
Metal[e]		23,110 [4]	31,000	39,000	42,000	45,000
Tungsten, metal		4,166	4,056	3,566	3,813	3,446
Vanadium, metal[e, 5]		560 [r]	560 [r]	560 [r]	560 [r]	560
Zinc:						
Mine output, Zn content		47,781	41,452	7,169	--	--
Oxide		75,813	74,843	77,234	77,102	77,000 [e]
Metal:						
Primary		534,830	536,768	504,532	501,135	509,717
Secondary, including remelted		132,417	138,453	148,715	137,560	122,859
Total		667,247	675,221	653,247	638,695	632,576
Zirconium, oxide[e]		9,800	10,000	10,800	11,000	11,000
INDUSTRIAL MINERALS						
Bromine[e]		20,000	20,000	20,000	20,000	20,000
Cement, hydraulic	thousand metric tons	67,376	69,629	69,942	67,685	62,810
Clays:						
Bentonite		455,282	421,629	425,000 [e]	430,000 [e]	435,000 [e]
Fire clay, crude[e]		470,000	460,000	460,000	450,000	450,000
Kaolin		11,553	10,500	10,500 [e]	11,000 [e]	11,000 [e]
Diatomite		126,225	130,005	130,000 [e]	120,000 [e]	115,000 [e]
Feldspar and related materials[e]		900,000	800,000	800,000	750,000	700,000
Gypsum	thousand metric tons	5,865	5,913	5,796	5,850	5,800 [e]
Iodine		7,264	8,095	8,724	9,282	9,500 [e]
Lime, quicklime	thousand metric tons	8,507	8,879	9,014	9,359	9,528

See footnotes at end of table.

TABLE 1—Continued
JAPAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
INDUSTRIAL MINERALS—Continued						
Nitrogen, N content of ammonia	thousand metric tons	1,101	1,083	1,091	1,114	1,110 [e]
Perlite[e]		240,000	240,000	240,000	230,000	230,000
Salt, all types[6]	thousand metric tons	1,225	1,227	1,166	1,190 [r]	1,200 [e]
Silica:						
Sand	do.	4,705	4,549	4,593	4,314	3,664
Stone, quartzite	do.	12,218	12,600	12,936	12,258	10,682
Sodium compounds, n.e.s.:[7]						
Soda ash[e]		400,000	400,000	400,000	400,000	400,000
Sulfate, anhydrous		130,107	138,000	138,000 [e]	140,000 [e]	140,000 [e]
Stone, crushed:						
Dolomite	thousand metric tons	3,726	3,534	3,695	3,655	3,370
Limestone	do.	161,858	165,240	166,621	165,982	156,813
Sulfur:						
Byproduct of metallurgy	do.	1,263	1,284	1,343	1,250 [r]	1,300 [e]
Byproduct of petroleum	do.	1,895	1,972	1,950	1,966	2,034
Talc and related materials:						
Talc		18,253	25,491	25,500 [e]	26,000 [e]	26,000 [e]
Pyrophyllite		405,222	351,111	350,000 [e]	345,000 [e]	350,000 [e]
Vermiculite[e]		6,000 [r]	6,000 [r]	6,000 [r]	6,000 [r]	6,000
MINERAL FUELS AND RELATED MATERIALS						
Carbon black	thousand metric tons	804	805	827	835	821
Coal, bituminous[8]	do.	1,339	1,114	1,341	1,340 [e]	1,300 [e]
Coke, including breeze, metallurgical	do.	38,314	38,095	38,543	38,707	38,568
Gas, natural:						
Gross[9]	million cubic meters	2,883	3,120	3,302	3,708	3,735
Marketed	do.	3,048	3,265	3,494	3,900 [e]	3,900 [e]
Petroleum:						
Crude	thousand 42-gallon barrels	5,247	5,772	5,643	6,041	6,200
Refinery products:						
Gasoline:						
Aviation[e]	do.	50	50	50	50	50
Other	do.	366,662	368,102	364,070	365,000 [e]	360,000 [e]
Asphalt and bitumen	do.	34,475	33,288	32,777	33,000 [e]	33,000 [e]
Distillate fuel oil	do.	243,425	251,729	251,311	247,000 [e]	250,000 [e]
Jet fuel	do.	64,846	69,946	76,390	80,000 [e]	82,000 [e]
Kerosene	do.	167,348	177,091	167,779	175,000 [e]	170,000 [e]
Liquefied petroleum gas	do.	50,881	56,352	55,696	57,000 [e]	58,000 [e]
Lubricants	do.	16,561	16,580	16,706	16,500 [e]	17,000 [e]
Naphtha	do.	125,252	135,792	136,140	138,000 [e]	139,000 [e]
Paraffin, wax	do.	902	902	824	850 [e]	800 [e]
Petroleum coke	do.	4,533	4,394	4,810	4,600 [e]	4,500 [e]
Refinery fuel and losses[e, 10]	do.	150,000	150,000	150,000	150,000	150,000
Residual fuel oil	do.	406,901	400,936	373,047	350,000 [e]	330,000 [e]
Unfinished oils[e]	do.	50,000	50,000	50,000	50,000	50,000
Total[e]	do.	1,680,000	1,720,000	1,680,000	1,670,000	1,640,000

[e] Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r] Revised. do. Ditto. -- Zero.

[1] Table includes data available through November 16, 2009.

[2] Includes alloyed and unalloyed ingot.

[3] Includes metal recovered from scrap and waste.

[4] Includes oxide of cerium, europium, gadolinium, lanthanum, neodymium, praseodymium, samarium, terbium, and yttrium.

[5] Represents metal content of vanadium pentoxide recovered from petroleum residues, ashes, and spent catalysts.

[6] Reported figure for fiscal year, which began on April 1 and ended on March 31 of the following year.

[7] Not elswhere specified.

[8] All major coal mines had closed by January 2002, but eight smaller mines were still in operation in 2008.

[9] Includes output from gas wells and coal mines.

[10] May include some additional unfinished oils.

TABLE 2
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Aso Cement Co., Ltd.	Tagawa and Kanda, Fukuoka Prefecture	2,400
Do.		Daiichi Cement Co., Ltd.	Kawasaki, Kanagawa Prefecture	1,169
Do.		Denki Kagaku K.K.	Omi, Niigata Prefecture	2,762
Do.		Hachinohe Cement Co., Ltd.	Hachinohe, Aomori Prefecture	1,533
Do.		Hitachi Cement Co., Ltd.	Hitachi, Ibaraki Prefecture	941
Do.		Mitsubishi Materials Corp.	Higashidori, Shimokita-gun, Apmori Prefecture; Higashiyama, Higashiiwai-gun, Iwate Prefecture; Yokoze, Saitama Prefecture; Kurosaki, Kyushu, and Higashitani, Fukuoka Prefecture	13,467
Do.		Mitsui Mining Co. Ltd.	Togawa, Fukuoka Prefecture	2,075
Do.		Myojo Cement Co., Ltd.	Itoigawa, Niigata Prefecture	2,482
Do.		Nippon Steel Chemical Co., Ltd.	Tobata, Kitakyushu, Fukuoka Prefecture	855
Do.		Nittetsu Cement Co., Ltd.	Muroran, Hokkaido Prefecture	1,589
Do.		Ryukyu Cement Co. Ltd.	Yabu, Nago, Okinawa Prefecture	722
Do.		Sumitomo Osaka Cement Co. Ltd.	Tamura, Fukushima Prefecture; Aso, Tochigi Prefecture; Motosu, Gifu Prefecture; Sakata, Shiga Prefecture; Ako, Hyogo Prefecture; and Susaki, Kochi Prefecture	14,402
Do.		Taiheiyo Cement Corp.	Ofunato, Iwate Prefecture; Chichibu, Kumagaya, and Saitama, Saitama Prefecture; Fujiwara, Mie Prefecture; Saiki and Tsukumi, Oita Prefecture; Kamiiso, Hokkaido Prefecture; and Tosa, Kochi Prefecture	28,800
Do.		Tokuyama Cement Co. Ltd.	Nanyo, Yamaguchi Prefecture	5,936
Do.		Tosoh Corp.	Shin Nanyo, Yamaguchi Prefecture	2,869
Do.		Tsuruga Cement Co. Ltd.	Tsuruga, Fukui Prefecture	1,710
Do.		Ube Industries Ltd.	Ube and Isa, Yamaguchi Prefecture, and Kanda, Fukuoka Prefecture	10,736
Coal		Kushiro Coal Mine Co. Ltd.[1]	Kushiro, Hokkaido Prefecture	750
Cobalt, refined	metric tons	Sumitomo Metal Mining Co. Ltd. (SMM)	Niihama, Ehime Prefecture	1,000
Copper, refined	do.	Mitsubishi Materials Corp.	Naoshima, Kagawa Prefecture	225,600
Do.	do.	Onahama Smelting and Refining Co. Ltd. (Mitsubishi Materials Corp., 49.29%; Dowa Mining Co. Ltd., 31.15%; Furukawa Co. Ltd., 8.31%; Furukawa Electric Co. Ltd. and Mitsubishi Cable Industries Ltd., 4.17% each; and others, 2.91%)	Onahama, Fukushima Prefecture	258,000
Do.	do.	Pan Pacific Copper Co., Ltd. (Nippon Mining & Metals Co., Ltd., 66%, and Mitsui Mining and Smelting Co., Ltd., 34%)	Saganoseki, Oita Prefecture; Hitachi, Ibaraki Prefecture; and Tamano, Okayama Prefecture[2]	710,000
Do.	do.	Sumitomo Metal Mining Co. Ltd. (SMM)	Besshi/Toyo (Saijyo), Ehime Prefecture	410,000
Do.	do.	Kosaka Smelting and Refining Co. Ltd. (wholly owned subsidiary of Dowa Mining Co. Ltd.)	Kosaka, Akita Prefecture	72,000
Gold:				
In concentrate	kilograms	Sumitomo Metal Mining Co. Ltd. (SMM)	Hishikari, Kagoshima Prefecture	9,000
Refined	do.	Kosaka Smelting and Refining Co. Ltd. (wholly owned subsidiary of Dowa Mining Co. Ltd.)	Kosaka, Akita Prefecture	24,000
Do.	do.	Mitsui Mining and Smelting Co., Ltd.	Takehara, Hiroshima Prefecture	22,000
Do.	do.	Mitsubishi Materials Corp.	Naoshima, Kagawa Prefecture	60,000
Do.	do.	Nippon Mining & Metals Co., Ltd.	Hitachi, Ibaraki Prefecture	30,000
Do.	do.	Sumitomo Metal Mining Co. Ltd. (SMM)	Niihama, Ehime Prefecture	36,000

See footnotes at end of table.

TABLE 2—Continued

JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iodine, crude	metric tons	Ise Chemical Industries Co. Ltd. (Asahi Glass Co. Ltd., 52.4%, and Mitsubishi Corp., 11.2%)	Oami-Shirasato, and Ichinomya, Chiba Prefecture; and Sadowara, Miyazaki Prefecture	3,600
Do.	do.	Godo Shigen Sangyo Co. Ltd. (Kanto Natural Gas Development Co. Ltd., 11%, and Mitsui & Co. Ltd., 10%)	Chosei, Chiba Prefecture	2,400
Do.	do.	Kanto Natural Gas Development Co. Ltd. (Mitsui Chemicals, Inc., 21.9%, and Godo Shigen Sangyo Co. Ltd., 14.3%)	Mobara, Chiba Prefecture	1,200
Do.	do.	Nihon Tennen Gas Co. Ltd. (Kanto Natural Gas Development Co. Ltd., 50%, and Tomen Corp., 41%)	Shirako and Yokoshiba, Chiba Prefecture	1,200
Do.	do.	Toho Earthtech, Inc. (Itochi Corp., 34.1%; Mitsubishi Gas Chemical Co. Ltd., 32.2%; Nippon Light Metal Co. Ltd., 31.1%)	Kurosaki, Niigata Prefecture	720
Do.	do.	Nippon Chemicals Co. Ltd. (Nippon Shokubai Co. Ltd., 17%; Takeda Chemical Industries Ltd., 16.4%; Chugai Boyeki Co. Ltd., 13.6%)	Isumi, Chiba Prefecture	720
Lead, refined	do.	Kamioka Mining and Smelting Co. Ltd.	Kamioka, Gifu Prefecture[3]	33,600
Do.	do.	Mitsui Mining and Smelting Co., Ltd.	Takehara, Hiroshima Prefecture	43,800
Do.	do.	Toho Zinc Co. Ltd.	Chigirishima, Hiroshima Prefecture	120,000
Do.	do.	Sumitomo Metal Mining Co. Ltd. (SMM)	Harima, Hyogo Prefecture	30,000
Do.	do.	Kosaka Smelting and Refining Co. Ltd.	Kosaka, Akita Prefecture	25,200
Do.	do.	Hosokura Smelting and Refining Mining Co. Ltd. (wholly owned subsidiary of Mitsubishi Materials Corp.)	Hosokura, Miyagi Prefecture[3]	22,200
Limestone		Mitsubishi Materials Corp.	Higashitani, Fukuoka Prefecture	10,000
Do.		Nittetsu Mining Co., Ltd.	Torigatayama, Kochi Prefecture; Oita, Oita Prefecture; and Shiriya, Aomori Prefecture	23,000
Do.		Sumikin Mining Co., Ltd.	Hachinohe Sekkai, Aomori Prefecture	5,500
Do.		Sumitomo-Osaka Cement Co. Ltd.	Ibuku, Shiga Prefecture, and Karazawa, Tochigi Prefecture	4,000
Do.		Shuho Mining Co., Ltd.	Sumitomo Cement Shuho, Yamaguchi Prefecture	8,200
Do.		Taiheiyo Cement Co. Ltd.	Ofunato, Iwate Prefecture; Ganji and Tsukumi, Oita Prefecture; Garo, Hokkaido Prefecture; Kawara, Fukuoka Prefecture, Tosayama, Kochi Prefecture; Taiheiyo Buko, Saitama Prefecture; and Shigeyasu, Yamaguchi Prefecture	46,000
Do.		Todaka Mining Co. Ltd.	Todaka-Tsukumi, Otia Prefecture	12,000
Do.		Ube Kosan Co. Ltd.	Ube Isa, Yamaguchi Prefecture	9,000
Manganese, electrolytic dioxide		Mitsui Mining and Smelting Co., Ltd.	Takehara, Hiroshima Prefecture	24
Do.		Tosoh Corp.	Hyuga, Miyazaki Prefecture	34
Nickel:				
In ferronickel	metric tons	Hyuga Smelting Co. Ltd. [wholly owned subsidiary of Sumitomo Metal Mining Co. Ltd. (SMM)]	Hyuga, Miyazaki Prefecture	22,000
Do.	do.	Yakin Oheyama Co. Ltd.	Oheyama, Kyoto Prefecture	12,720
Do.	do.	Pacific Metals Co. Ltd.	Hachinohe, Aomori Prefecture	40,800
In oxide	do.	Tokyo Nickel Co. Ltd.	Matsuzaka, Mie Prefecture	60,000
Refined	do.	Sumitomo Metal Mining Co. Ltd. (SMM)	Niihama, Ehime Prefecture	36,000

See footnotes at end of table.

TABLE 2—Continued
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Pyrophyllite		Goto Kozan Co. Ltd.	Goto, Nagasaki Prefecture	204
Do.		Ohira Kozan Co. Ltd.	Ohira, Okayama Prefecture	132
Do.		Sankin Kogyo Co. Ltd.	Otsue, Hiroshima Prefecture	72
Do.		Shinagawa Shirenga Co. Ltd.	Mitsuishi, Okayama Prefecture	180
Do.		Shokozan Kogyosho Co. Ltd.	Yano-Shokozan, Hiroshima Prefecture	180
Do.		Showa Kogyo Co. Ltd.	Showa-Shokozan, Hiroshima Prefecture	60
Steel, crude		JFE Steel Corp. (wholly owned subsidiary of JFE Holdings Inc.)	Chiba, Chiba Prefecture; Kawasaki (Keihin), Kanagawa Prefecture; Nishinomiya, Hyogo Prefecture; Handa Aichi Prefecture; Fukuyama, Hiroshima Prefecture; and Kurashiki, Okayama Prefecture	33,835
Do.		Kobe Steel Ltd.	Kakogawa and Kobe, Hyogo Prefecture	8,943
Do.		Nippon Steel Corp.	Oita, Oita Prefecture; Kawata, Fukuoka Prefecture; Kimitsu, Chiba Prefecture; and Nagoya, Aichi Prefecture	33,199
Do.		Sumitomo Metal Industries, Ltd.	Kashima, Ibaraki Prefecture; Kokura, Fukuoka Prefecture; and Wakayama, Wakayama Prefecture	12,820
Do.		Nisshin Steel Co. Ltd.	Kuri, Hiroshima Prefecture; Osaka City; Shunan, Yamaguchi Prefecture; and Toyo, Ehime Prefecture	4,000
Titanium:				
In sponge metal		Sumitomo Titanium Corp. (Sumitomo Metal Industries, Ltd., 75.2%, and Kobe Steel Ltd., 24.8%)	Amagasaki, Hyogo Prefecture	24
Do.		Toho Titanium Co. Ltd. (Nippon Mining & Metals Co., Ltd., 47%; Mitsui & Co. Ltd., 20%; others, 33%)	Chigasaki, Kanagawa Prefecture	15
In dioxide	metric tons	Fuji Titanium Industry Co. Ltd. (Ishihara Sangyo Kaishia Ltd., 24.8%, and others, 75.2%)	Kobe, Hyogo Prefecture	17,400
Do.	do.	Ishihara Sangyo Kaisha Ltd.	Yokkaichi, Mie Prefecture	154,800
Do.	do.	Sakai Chemical Industries Co. Ltd.	Onahama, Fukushima Prefecture	60,000
Do.	do.	Tayca Corp.	Saidaiji, Okayama Prefecture	60,000
Do.	do.	Titan Kogyo Kabushiki Kaisha	Ube, Yamaguchi Prefecture	16,800
Zinc, refined	do.	Akita Smelting Co. Ltd. [Dowa Mining Co. Ltd., 57%; Nippon Mining & Metals Co., Ltd., 24%; Sumitomo Metal Mining Co. Ltd. (SMM), 14%; Mitsubushi Materials Corp., 5%]	Iijima, Akita Prefecture	200,400
Do.	do.	Hachinohe Smelting Co. Ltd. (Mitsui Mining and Smelting Co. Ltd., 57.7%; Nippon Mining & Metals Co., Ltd., 27.8%; Toho Zinc Co. Ltd. and Nisso Smelting Co. Ltd., 14.5%)	Hachinohe, Aomori Prefecture	117,600
Do.	do.	Hikoshima Smelting Co. Ltd.	Hikoshima, Yamaguchi Prefecture	84,000
Do.	do.	Kamioka Mining and Smelting Co. Ltd.	Kamioka, Gifu Prefecture	72,000
Do.	do.	Toho Zinc Co. Ltd.	Annaka, Gunma Prefecture	139,200
Do.	do.	Sumitomo Metal Mining Co. Ltd. (SMM)	Harima, Hyogo Prefecture	90,000

Do., do. Ditto.

[1] Coal mining operations continued following the establishment of Kushiro Coal Mine Co. Ltd. in 2002.

[2] Saganoseki Smelter and Refinery and Hitachi Refinery [450,000 metric tons per year (t/yr)] and Tamano Smelter and Refinery (260,000 t/yr).

[3] Secondary lead smelter and refinery.

TABLE 3
JAPAN: SUPPLY AND DEMAND FOR SELECT NONFERROUS METALS

(Metric tons unless otherwise specified)

	Refined copper			Refined lead		
	2006	2007	2008	2006	2007	2008
Stocks at the beginning	97,672	102,807	101,931	9,554	17,562	14,224
Production	1,532,055	1,576,818	1,539,838	219,640	219,423	224,905
Imports	75,256	102,273	90,470	34,955	24,800	25,497
Total supply	1,704,983	1,781,898	1,732,239	264,149	261,786	264,626
Exports	319,815	428,079	423,455	4,404	19,147	26,246
Reported consumption	1,252,185	1,241,893	1,219,740	240,217	229,581	211,261
Total demand	1,572,000	1,669,972	1,643,195	244,621	248,728	237,507
Stocks at the end	102,807	101,931	124,379	17,562	14,224	22,134
Apparent consumption	1,282,361	1,251,888	1,184,405	242,183	228,414	216,246
	Refined zinc			Silver (kilograms)		
	2006	2007	2008	2006	2007	2008
Stocks at the beginning	106,402	93,878	82,069	843,152	1,190,744	881,919
Production	614,331	597,650	615,533	2,253,203	2,263,009	2,042,604
Remelting	NA	NA	NA	228,498	391,869	253,374
Imports	40,649	53,145	45,287	1,838,845	1,540,073	2,098,409
Total supply	761,382	744,673	742,889	5,163,698	5,385,695	5,276,306
Exports	73,369	74,187	84,505	1,605,384	2,205,575	1,978,353
Reported consumption	469,592	487,578	450,010	2,241,756	2,262,457	1,868,883
Total demand	542,961	561,765	534,515	3,847,140	4,468,032	3,847,236
Stocks at the end	93,878	82,069	94,521	1,190,744	881,919	959,905
Apparent consumption	594,135	588,417	563,863	2,367,570	2,298,201	2,338,048

NA Not applicable.

Source: Japan Mining Industry Association.

TABLE 4
JAPAN: RESERVES OF MAJOR MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity		Exploitable reserves
Coal[2]		773,000
Dolomite		913,000
Gold ore, Au content	kilograms	159,000
Iodine		5,000 [e]
Limestone		40,400,000
Pyrophyllite		59,700
Silica sand		73,600
Silica stone, white		462,000

[e] Estimated.

[1] Reserves as of 2004.

[2] Recoverable reserves, including brown coal.

Source: Natural Resources and Fuel Department, Agency of Natural Resource and Energy.

THE MINERAL INDUSTRY OF NORTH KOREA

By Lin Shi

North Korea's identified mineral resources included apatite (phosphate rock), barite, coal, copper, feldspar, fluorspar, gold, graphite, iron ore, kaolin, lead, limestone, magnesite, molybdenum, salt, silica, silver, tungsten, and zinc. Among these minerals were relatively large deposits of coal, iron ore, limestone, and magnesite. North Korea lacked economic resources of crude petroleum. The country used its minerals domestically for industrial and military purposes and also exported significant quantities to gain foreign currencies. The country's water resources provided significant hydroelectric power generation capacity (U.S. Library of Congress, 2007).

North Korea's predominant domestic sources of commercial energy were coal and hydroelectric power. The country produced hard coal, lignite, and peat and generated electricity through its coal-fired thermal powerplants and hydroelectric powerplants. About 6% of its primary energy consumption was from imported oil (U.S. Library of Congress, 2007).

Following elections in the Republic of Korea in 2008, inter-Korean relations went through an adjustment period. Dialogue between the Governments of North Korea and the Republic of Korea decreased; exchanges and cooperation in the private sector continued, however. The number of cross-border travelers in 2008 increased to 186,775, or by 17.3%, and the value of trade between the two Koreas increased to $1.82 billion, or by 1.2%. The number of factories operating in 2008 in the Gaeseong Industrial Complex (GIC) of North Korea increased by 43% to 93; also, the value of production increased by 36% to $250 million, and the number of North Korean employees increased by 72% to 39,000 (Ministry of Unification, 2008).

According to the Bank of Korea (BOK) of the Republic of Korea, North Korea's real annual gross domestic product (GDP) increased by 3.7% in 2008 following the negative growth experienced in 2006 (-1.1%) and 2007 (-2.3%). The mining and manufacturing sector grew by 2.5% in 2008, which was a significant increase compared with the decrease of 109% in 2007. Production in the mining sector increased by 2.3% compared with an increase of 0.4% in 2007 owing to expansions across the sector, including in the coal, metallic mineral, and nonmetallic mineral industries. Production in the heavy industries manufacturing sector increased by 3.3% compared with an increase of 2.3% in 2007 owing primarily to expansions in the base metals, chemicals, and machinery products industries. The 6.1% increase in production in the electricity, gas, and water sector was reflected in the increase in both the hydroelectric and the thermal power generation industries. The construction sector grew by 1.1% owing to increased housing construction. In 2008, contributions to the growth in the GDP were made by the mining and manufacturing sector (34.6%); the service sector (32.2%); the agriculture, forestry, and fisheries sector (21.6%); the construction sector (8.3%); and the electricity, gas, and water sector (3.4%) (Bank of Korea, 2009).

Minerals in the National Economy

The mining sector accounted for 12.1% of the country's total GDP in 2008 (Bank of Korea, 2009).

Production

In 2008, North Korea produced about 6.4 million metric tons (Mt) of cement, about 25.1 Mt of coal, about 5.3 Mt of iron ore, and about 1.3 Mt of steel. The country also produced about 479,000 metric tons (t) of fertilizer, and about 94,000 t of nonferrous metals. The BOK reported that the volume of power generation was about 255 billion kilowatts (Bank of Korea, 2009).

North Korea's major mineral mine production included coal, copper, graphite, iron ore, lead, limestone, magnesite, salt, tungsten, and zinc. Production of processed minerals included cadmium, cement, coke, refined copper, ferroalloys, refined lead, magnesia clinker, nitrogen fertilizer materials, pig iron, crude steel, and refined zinc. The domestic industries consumed most of the country's mineral production (table 1).

Structure of the Mineral Industry

North Korea's mineral industry comprised a coal mining sector, an industrial mineral mining and processing sector, and a ferrous and nonferrous metals mining and processing sector. Most of the large-scale mining and mineral-processing enterprises in North Korea were owned and operated by the central Government. Provincial and local governments owned and operated various small-to-medium-scale mining and mineral processing facilities. In the past 4 years, China, Egypt, the Republic of Korea, and other countries participated in joint ventures in North Korea for the development and operation of cement, coal, copper, gold, graphite, iron ore, lead and zinc, magnesite, and molybdenum production facilities in North Korea.

The country's nuclear energy generation industry was the subject of major international political discord because of suspicions about the militarization of this capability. Several agreements had been signed that led to the construction of light water reactors and training for technical staff to operate them. Disclosures about North Korea's nuclear weapons program raised international protests and have delayed development of this energy sector (U.S. Library of Congress, 2007).

Mineral Trade

In 2008, North Korea's overall trade volume (goods-based) increased by 29.9% and amounted to $3,820 million; its exports increased by 22.8% and amounted to $1,130 million, and its imports increased by 33.2% and amounted to $2,690 million. Imports from the Republic of Korea to North Korea were valued at $888.1 million, which was a decrease of 14% compared with those of 2007. North Korean exports to the Republic of Korea increased by 21.8% to $932.3 million; the increase was owing to the increased cross-border trade in products processed on a commission basis, as well as to the increased imports from the GIC (Bank of Korea, 2009).

The Korean Friendship Association (KFA) of North Korea was founded in November 2000 to encourage the building of international ties between North Korea and other countries of the world. The KFA had members from 120 countries, and it had offices in North Korea, Norway, Spain, and Thailand. It was the only official North Korean organization that could conduct foreign trade. North Korea exported cement, coal, gold, graphite, iron ore, crude magnesite, magnesia clinker, pig iron, salt, steel products, and zinc through the KFA, and the exports earnings paid for the country's large imports of chemical fertilizers and crude petroleum. Base metals and zinc were exported principally to China and the Republic of Korea; coal, iron ore, and crude magnesite were exported mainly to China; gold was exported mainly to Thailand; and magnesia clinker was exported mainly to Japan and other countries worldwide. North Korean mineral producers exported their output through the KFA by way of China's Dandong Port or Dalian Port. Exports included caustic calcined magnesite, cement, granite and marble, high concentrated mercury, high concentrated tungsten oxide powder, and silicon metal. Shipbuilding, ship parts, and ship repair services were major sources of foreign currency earnings from East European and Southeast Asian countries. North Korea had trade offices in Dandong, China; Indonesia; and Vladivostok, Russia, to promote cooperation in shipbuilding industry activities with other countries. Crude petroleum and fertilizers were imported mainly from China (Korean Friendship Association, 2009).

North Korea's ability to attract foreign investments was limited because of its large amount of external debt. This impediment did not stop North Korea from pursuing new foreign investments, particularly for its first special economic, or free trade, zone at Najin–Sonbong in northeast North Korea. This zone was accessible to Russia by railroad and to China by road, but to the rest of North Korea only by air. The Sinuiju Special Administrative Region, which is located on the western end of the border with China, was a self-managed entity aimed at fostering bilateral trade. Two other economic zones—the Mount Kumgang scenic and sport-tourist zone and the Kaesong Special Industrial Zone—are located in southeast North Korea. International concern about nuclear proliferation also had a negative effect on the flow of foreign direct investment into the country (U.S. Library of Congress, 2007).

Commodity Review

Metals

Copper.—The Republic of Korea shipped 1,000 t of copper to North Korea in May 2008 in return for North Korea agreeing to disable its nuclear plants. The shipment had a value of $8.5 million (Thomas Financial News, 2008).

According to a report by the Institute for Far Eastern Studies, in 2008, there was no feasible way technically to restore North Korea's Chungnyun Mine, which was facing severe economic difficulties because of flooding. The mine is located in Hyesan, Ryanggang Province. Owing to the disabling of production at the mine, the country found it necessary to import a large amount of copper to meet the requirements of the manufacturing sector; the Government imported most of the required copper from Chile. Senior authorities in North Korea were demanding that the Chungnyun Mine be saved at any cost. The construction of a powerplant in Jangan-Ri, Hyesan, Ryanggang Province, was identified as causing the flooding of the mine (Institute for Far Eastern Studies, 2008).

Iron and Steel.—By the beginning of 2008, the Republic of Korea had provided 5,100 t of steel plates to North Korea, as part of the six-party deal that involved each participating country agreeing to provide energy or alternative compensations to North Korea in exchange for North Korea's disablement of its nuclear facilities (Korea Times, The, 2007; Thomas Financial News, 2008).

Jilin Newspaper of China reported that for the first half of 2008, North Korea exported 64,000 t of iron ore to Chinese entrepreneurs in Yanji, which was a 2.3% increase from the same period in 2007. The Chinese iron and steel corporations—Tonghua Steel Group, Yanbian Tianchi Trade Incorporated Co., and Zhonggang Group—purchased 50-year mining rights to North Korea's Musan Mine in 2005. In late 2007, these companies attempted to invest an additional $1 billion (¥7 billion) in the mine to increase the amount of iron ore that they received from the mine, but they could not make the additional investment (Daily NK, 2008).

Zinc.—The Komdok Mine, which is located near Tancheon in South Hamgyong Province (Hamgyongnam Do) was North Korea's major zinc production site. The country's zinc production and its exports of zinc to the Republic of Korea in 2008 were unchanged from 2007 (table 1).

North Korea's Komdok zinc mine was equipped with Siemens AG's process instrumentation. As planned, Siemens would supply a wide range of instruments for various applications in North Korea, including Sitrans F MAG 3100 and MAG 5000 magnetic-inductive flowmeters; Sipan 34 liquid analyzers with sensors for sulfuric acid, sodium hydroxide, and other compounds; Sipos 5 Flash electrical actuators; special control valves; MSI belt scales with BW 500 for zinc concentrate; and gas analysis cabinets with Ultramat 6 analyzers and the appropriate sampling and preparation systems (Siemens AG, 2006).

Industrial Minerals

Graphite.—According to Yonhap News Agency, at the end of December 2007, the Republic of Korea had plans to develop two resource-rich regions in North Korea that could benefit both the Republic of Korea and North Korea and fuel cross-border economic cooperation. Dacheon in North Korea had two or three graphite mines that hold promise for future development, and the area was planned to be built up as a special resources zone with emphasis being placed on constructing electricity-generating plants, power cables, and railways. The Haeju-Nampo region of North Korea offered support to local companies to obtain development rights for graphite, limestone, and phosphate. The Republic of Korea's state-run Korea Resources Corp. held a 50% stake in a graphite manufacturing facility that shipped products to the Republic of Korea. The Republic of Korea planned to allocate about $1 billion to this effort in 2008, which was an increase from the $639 million that had been allocated in 2007 (Yonhap News Agency, 2008).

Magnesium Compounds.—North Korea's magnesite is found in Ryong Yang and Tancheon, where magnesite reserves are among the world's largest, together with adjacent deposits in China. Steel manufacturers use this refractory mineral to line blast furnaces (MSN Encarta, 2009).

Mineral Fuels

Coal.—North Korea produced about 25.1 Mt of coal in 2008, which was an increase of 4% from the 24.1 Mt produced in 2007. According to the 2008 BP Statistical Energy Survey, North Korea had coal reserves of 600 Mt at yearend 2007. The country's anthracite resources are located mainly in the Provinces of North Pyongan and South Pyongan. Bituminous coal is concentrated mostly in North Hamgyong Province and South Pyongan Province. According to an estimate by the North Korean Economy Watch in 2006, the number of coal mines in North Korea totaled about 600; 70 of those mines were anthracite mines; 30, bituminous coal mines; and more than 500, small- and medium-scale mines with various types of coal. The mines, which produced various grades of coal, were located in several coal-producing Provinces in the northern and southern parts of North Korea (table 1; MBendi Information Services (Pty) Ltd., 2009).

In September 2008, the Government distributed 200 t of wheat from the United States to the Northern Coal Mine Enterprise to feed the starving coal miners who had had no food for about a month in Saebyul County, North Hamgyong Province, and to keep the coal mines operating. By the end of October 2008, colder temperatures had led to an increase in the price of coal to $2.65 per cart from $1.76 per cart. The price then increased rapidly to $4.41 throughout Eunduk and Saebyul Counties in North Hamgyong Province. Residents who made their living by mining coal strived to increase mine production to take advantage of the increase in the price of coal (Good Friends, 2009a, b).

Although North Korea promoted raw material exports as a means of generating much-needed hard currency and exported about 200,000 metric tons per year of coal to the Republic of Korea's Pohang Iron and Steel Co. (POSCO), the Republic of Korea's investment in North Korea's rich mineral resources slowed in 2008 owing to the dispute concerning North Korea's nuclear program and mixed views on whether such investment would be profitable (Agence France Presse, 2008).

Crude Petroleum.—As a result of international negotiations that led to a landmark nuclear agreement that was made final in 2007, North Korea agreed to receive 1 Mt of heavy fuel oil in return for permanently disabling its Yongbyon reactor complex. In December 2008, the six-party group negotiating with North Korea suspended oil shipments because of Pyongyang's refusal to accept a plan for verifying its nuclear program; however, Russian oil deliveries that were already in process continued going forward. The group's action came 1 day after the breakdown of talks in Beijing on a verification protocol, and by that time, more than one-half of the volume of the fuel oil had been supplied by China, the Republic of Korea, Russia, and the United States (VOANews.com, 2008).

Outlook

Although North Korea's GDP of $16.7 billion in 2008 was a 3.7% increase compared with the previous year's output, it was still less than that achieved at the end of the 1980s. The increase in the country's overall production since 2007 was bolstered by increased output in coal, crops, and electricity.

The Republic of Korea paid $26.8 million in 2008 in wages to North Korean workers at a joint industrial complex just north of the border. The wages were directly wired to North Korean Government bank accounts. In reaction to the continued development of nuclear weapons and missile programs, however, the Republic of Korea began to cut off all economic aid to North Korea (UPI Asia Online, 2009a).

According to the BOK, the factors responsible for North Korea's 2008 economic growth—foreign aid and a boom year in grain production—were temporary and not necessarily an indication that North Korea's strength and ability to grow economically was improved internally. During the year, North Korea poured national resources into boosting its military capabilities, including nuclear missile tests; the country's command economy in the future will likely suffer contraction because of the wide-ranging international economic sanctions that have been imposed by the international community. The tough sanctions will most likely force outside donors to reduce their aid to North Korea and to cut trade with Pyongyang (UPI Asia Online, 2009b).

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TABLE 1
NORTH KOREA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
METALS						
Cadmium metal, smelter		200	200	200	200	200
Copper:						
Mine output, Cu content		12,000	12,000	12,000	12,000	12,000
Metal:						
Smelter, primary and secondary		15,000	15,000	15,000	15,000	15,000
Refinery, primary and secondary		15,000	15,000	15,000	15,000	15,000
Gold, mine output, Au content	kilograms	2,000	2,000	2,000	2,000	2,000
Iron and steel:						
Iron ore and concentrate, marketable:						
Gross weight	thousand metric tons	4,580	5,000	5,040	5,130	5,316 [4]
Fe content	do.	1,300	1,400	1,400	1,400	1,488
Metal:						
Pig iron	do.	900	900	900	900	900
Ferroalloys, unspecified	do.	10	10	10	10	10
Steel, crude	do.	1,070	1,070	1,180	1,230	1,279 [4]
Lead:						
Mine output, Pb content		13,000	13,000	13,000	13,000	13,000
Metal:						
Smelter, primary and secondary		13,000	13,000	13,000	13,000	13,000
Refinery, primary and secondary		9,000	9,000	9,000	9,000	9,000
Silver, mine output, Ag content		20	20	20	20	20
Tungsten, mine output, W content		280 [r]	650 [r]	900 [r]	250 [r]	350
Zinc:						
Mine output, Zn content		62,000	67,000	67,000	70,000	70,000
Metal, primary and secondary		67,000	72,000	72,000	75,000	75,000
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	5,630	5,700	6,160	6,130	6,415 [4]
Fluorspar		12,000	12,500	12,500	12,500	12,500
Graphite		30,000	30,000	30,000	30,000	30,000
Magnesium:						
Magnesite, crude		60,000 [r]	40,000 [r]	60,000 [r]	55,000 [r]	150,000
Magnesium compounds	thousand metric tons	300	346	345	350	350
Nitrogen, N content of ammonia	do.	100	100	100	100	100
Phosphate rock		300,000	300,000	300,000	300,000	300,000
Salt, all types		500,000	500,000	500,000	500,000	500,000
Sulfur	thousand metric tons	42	42	42	42	42
Talc, soapstone, pyrophyllite		50,000	50,000	50,000	50,000	50,000
MINERAL FUELS AND RELATED MATERIALS						
Coal	thousand metric tons	22,800	23,500	23,000 [r]	24,100	25,060 [4]
Coke	do.	2,000	2,000	2,000	2,000	2,000

[r] Revised. do. Ditto.

[1] Estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2] Table includes data available through July 31, 2009.

[3] In addition to the commodities listed, crude construction materials, such as sand and gravel and other varieties of stone, and refined petroleum products and rare earths presumably are produced, but available information is inadequate to make reliable estimates of output.

[4] Reported figure.

TABLE 2
NORTH KOREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Cement	Sunchon Cement Complex	Sunchon, Pyongannam Province	3,000
Do.	Samgwong Cement Complex (Orascom Construction Industries of Egypt, 50%)	Samgwong, Kangwon Province	2,500
Do.	Gomusan Cement Factory	Cheongjin, Hamgyongbuk Province	2,000
Do.	Cheonnaeri Cement Factory	Cheonae, Hamgyongnam Province	1,000
Coal	Anju Coal Mining Complex and Sunchon Coal Mining Complex	Anju, Kaechon, Pukchang, Sunchon, and Tokechon, South Pyongan (Pyongannam) Province; North Pyongan (Pyonganbuk) Province	9,500
Do.	Saebyol Coal Mining Complex (Northern Coal Mine Enterprise)	Saebyo, North Hamgyong (Hamgyongbuk) Province	6,000
Copper, mine output, Cu content	Hyesan Youth Copper Mine (Luanhe Industrial Group and another unnamed Chinese Company, 50%)	Hyesan, Yanggang Province	13
Gold, mine output, Au content kilograms	Gumsan (Kumsan) Joint Venture Co.	Sierra near Changjin northwest of Hamgyongbuk Province	530
Graphite	Yeongchon Graphite Mine (Joint venture of Korea Resources Corp. and Government of North Korea)	Yeongchon, Yonan County, South Hwanghae Province	3
Iron ore, concentrate, gross weight	Ministry of Metal and Machinery, Department of Mines, Musan Iron Ore Mine Complex	Near the town of Musan, Hamgyongbuk Province	10,000
Do.	Unryul Mine	Unryul, Hwanghaenam Province	1,000
Lead:			
In concentrate	Korea Zinc Industrial Group	Komdok, near Tancheon, Hamgyongnam Province	20
Refined	do.	Munpyong, Kangwon Province	32
Magnesite, concentrate, gross weight	Korea Magnesia Clinker Industry Group	Dae Hung and Ryong Yang, Hamgyongnam Province; Paek Bai near Kim Chaeck, Hamgyongbuk Province	2,500
Magnesia clinker	do.	Tancheon and Dae Hung, Hamgyongnam Province; Song Jin, Hamgyongbuk Province	1,150
Steel, crude			
Do.	Kim Chaek Iron and Steel Complex (Ministry of Metal and Machinery)	Chongjin, Hamgyongbuk Province	2,400
Do.	Hwanghae (Hwanghai) Iron Works	Songnim, Hamgyongbuk Province	1,500
Do.	Kangson Works	Kangson, Hwanhaebuk Province	960
Do.	Chullima Steel Works	Nampo, Pyungnam Province	760
Zinc:			
In concentrate	Korea Zinc Industrial Group	Komdok near Tancheon and Sankok near Kowon, Hamgyongnam Province; Nakyong, Hwanhaenam Province	80
Refined	do.	Munpyong, Kangwon Province; Tancheon, Hamgyongnam Province	100

[e] Estimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto.

THE MINERAL INDUSTRY OF THE REPUBLIC OF KOREA

By Lin Shi

The Republic of Korea largely relied on external resources for much of its mineral requirements. The country continued to import a significant percentage of the mineral and energy resources needed to support the country's consumption and robust manufacturing sector in 2008, including almost the entire domestic demand for bituminous coal and for ores and concentrates of copper, iron, lead and zinc, and some other minerals. The mining sector contributed very little to the country's gross domestic product (GDP).

In 2008, the Republic of Korea's real GDP grew by about 2.5% to about $1.3 trillion based on purchasing power party; of this amount, services accounted for about 57%; manufacturing 40%; and agriculture, about 3%. The population was estimated to be 48.5 million with a labor force of about 24.4 million, distributed as follows: services, 65%; manufacturing, 25%; and agriculture, about 7%. The unemployment rate was about 3%. The country's annual exports were valued at $422 billion, and annual imports were valued at $435 billion. The country's 2008 reserves of foreign exchange and gold totaled $201.2 billion (U.S. Central Intelligence Agency, 2008; Bank of Korea, 2009, p. 130).

The Republic of Korea was the leading producer of cadmium, slab zinc, and steel in the world. It was also a major producer of cement, refined copper, pyrophyllite, talc, and zeolites in the Asia and the Pacific region and one of the region's significant consumers and importers of coal, natural gas, and crude petroleum; of ores and concentrates of copper, iron, lead, and zinc; and of nickel oxide sinter.

Because of its small supply of domestic mineral resources, the Republic of Korea relied heavily on imports to meet its domestic demand for most of the raw materials needed to supply its energy and manufacturing industries. It relied 100% on imports to meet its requirements for bituminous coal, ores and concentrates of copper, and fluorite and phosphate rock. It also relied on imports to meet most of its domestic requirements for iron ore and nonferrous metallic minerals, such as lead and zinc. According to Korea Resources Corp. (KORES), the Republic of Korea has relatively large reserves of such industrial minerals as kaolin, limestone, pyrophyllite, silica stone (quartzite), and talc. It has smaller reserves of antimony, copper, gold, iron ore, lead, molybdenum, silver, tin, tungsten, and zinc. It also has small reserves of coal and offshore natural gas.

To compensate for the small amount of mining activities on the domestic front, the Republic of Korea entered into partnerships worldwide to develop mining properties around the globe so it could import energy resources and minerals in exchange for commercial services and manufactured goods. According to the Korean National Statistical Office, the Korean construction sector's overseas orders more than doubled in 2008 from the previous year and were valued at a combined $26.3 billion (32.7 trillion won[1]), which was up by 102.9%, or by $13.39 billion (16.65 trillion won) from the previous year owing to a construction boom in Asia and the Middle East (Yonhap News Agency, 2009b). The Middle East was the principal source of energy supplies to the Republic of Korea; the region supplied 85% of the country's mineral fuels. In return, the Republic of Korea was one of the leading providers of manufactured goods and services to the Middle East region, including cars, consumer electronics, heavy construction equipment, liquefied natural gas tankers, and trucks. The Republic of Korea also provided services in the Middle East region as a construction contractor in the power sector, including the construction of nuclear powerplants, and in the water sector (Meed, 2009a-c).

The economy of the Republic of Korea was highly responsive to volatility in oil prices and fluctuations in the exchange rate. There was also a strong relationship between its GDP growth and its demand for energy. When the price of oil hit a high of $147 per barrel in July 2008, the effect on the Government's treasury was felt almost immediately, and the country posted a current account shortfall of $6.41 billion—its first shortfall in 11 years. State-run Korea Gas Corp. (Kogas) imported 2.18 million metric tons (Mt) of liquefied natural gas (LNG) in April 2008. The Government actively encouraged its leading energy companies to create agreements to help secure future supplies of oil and gas from the Middle East. The Republic of Korea and other Asian countries agreed to share their 10-year projections of oil supply and demand with the Gulf Cooperation Council (GCC) members. The Republic of Korea planned not only to continue to purchase oil and LNG from such Middle Eastern countries as Saudi Arabia and the United Arab Emirates (UAE) but was also looking for new suppliers in Iraq (Meed, 2009b).

Minerals in the National Economy

The mining and quarrying sector accounted for only 0.22% of the country's real GDP and thus was a relatively small sector compared with other sectors of the Republic of Korea's economy. The sector produced small quantities of anthracite coal, concentrates of ferrous metals, mineral ores, and nonferrous metals. According to the Bank of Korea, the value of production (at 2000 constant prices) of the mining and quarrying sector decreased by 7.0% in 2008 and the country's economy grew by 2.5%. The output of the industrial minerals (nonmetal) sector accounted for about 70% of the real value of the country's total mineral production (Bank of Korea, 2009, p. 188).

Government Policies and Programs

In 2008, state-owned KORES amended the corporate bylaws and increased its capital from $600 billion to $2,000 billion. Back in June 1967, the Government had established KORES to support the development of the domestic private sector mining industry, to conduct research, and to provide technical assistance in the acquisition and development of overseas mineral resources. KORES' Inter-Korea Mineral Resources Cooperation Department was engaged in various cooperative projects with North Korea, including collecting data on the mines in North Korea, establishing contacts and communications to assist in the development of the mines in North Korea, overseeing the operations of the South-North Collaboration Council for Resources Development to assist private enterprise projects in the North Korea, and so forth. KORES' policy was that endeavors to develop the mineral resources of North Korea would help the Republic of Korea secure a steady supply of minerals at a low price owing to North Korea's large reserves of various minerals and its proximity to the Republic of Korea (Korea Resources Corp., 2008a, b).

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[1] Where necessary, values have been converted from Republic of Korea won (W) to U.S. dollars ($) at the rate of W1,102.59 = $1.00.

The Republic of Korea was considering opening new embassies in some energy-rich nations and relocating overseas diplomatic staff as part of its efforts to bolster its energy diplomacy. In late 2008, the President of the Republic of Korea approved the Foreign Ministry's plan to set up embassies in Bolivia, Cameroon, the Democratic Republic of Congo [Congo (Kinshasa)], Kyrgyzstan, and Trinidad and Tobago, and to establish a consulate general in Irkutsk, Russia. It also planned to support its national interests on the African continent, through signed memorandums of understanding (MOUs) to increase investment in natural gas, crude oil, and other resources and in exploration and development projects; to acquire contracts for construction of such infrastructure as roads and dams; and to acquire imports of mineral resources, such as cobalt, copper, diamond, and zinc. The country was competing with China and Japan to establish economic influence on the continent so as to secure oil and mineral resources to sustain its economy (Emerging Minds, 2008; Xinhua News, 2008).

Production

The Republic of Korea's mining sector produced ferrous and nonferrous metals, including copper, gold, iron ore, lead, silver, and zinc. The country mined industrial minerals, including diatomaceous earth, feldspar, graphite, limestone, mica, pyrophyllite, quartzite, salt, sand, talc, and zeolites. Mine output of ferrous and nonferrous metals was very small compared with the country's raw material requirements for its ferrous and nonferrous metal refining industries. Mined industrial minerals were mostly for domestic consumption. The country also produced anthracite coal and a small amount of natural gas from an offshore gasfield, but no crude petroleum (tables 1, 2).

In 2008, production of cadmium, ferromanganese, gold, iron ore, lead, pig iron, silver, crude steel, and zinc metal all increased whereas production of bismuth, mine output of copper and refined copper, refined gold, nickel, and mine output of zinc decreased. Among industrial minerals, production of clays, diatomaceous earth, graphite, mica, and salt all increased whereas production of cement, feldspar, limestone, quartzite, sand, and petroleum refinery products decreased (table 1).

Structure of the Mineral Industry

The Republic of Korea's large coal mining, natural gas, petrochemical, and petroleum refining companies were state owned and under the supervision of the Ministry of Commerce, Industry and Energy (MCIE). The rest of the mining, quarrying, and ferrous nonferrous metal processing companies were privately owned and operated.

Mineral Trade

In 2008, the value of the Republic of Korea's total annual exports increased by 13.6% to $422 billion from $371.5 billion in 2007 owing mainly to a 56.2% increase in exports of petroleum refinery products to $37.8 billion from $24.2 billion; a 20.6% increase in exports of iron and steel products to $38.1 billion from $31.6 billion; and a 13.9% increase in exports of chemicals to $41.9 billion from $36.8 billion (Bank of Korea, 2009, p. 130-131).

The value of the country's total annual imports increased by 22% to $435.3 billion from $356.8 billion in 2007 owing mainly to a 53.9% increase in imports of iron ore to $37.1 billion from $24.1 billion, and a 48.9% increase in imports of mineral fuels (coal, natural gas, and crude petroleum) to $140.9 billion from $94.6 billion (Bank of Korea, 2009, p. 130-131).

The Republic of Korea's major energy resources were coal, hydropower, natural gas, nuclear power, and other renewable energy sources. The country was a significant importer of LNG and the fifth ranked net importer of oil in the world. In recent years, the increased imports of coal and natural gas have gradually decreased the share of oil in the total energy usage; oil had previously accounted for the largest share of the country's energy consumption (U.S. Energy Information Administration, 2009).

Commodity Review

Metals

Aluminum.—The Republic of Korea's aluminum products included metal coil, plate, and sheet; extrusion products; foil; metal powders; wheels for automobiles; and other casting products. The country's domestic aluminum product manufacturers were also the major primary aluminum and aluminum alloy consumers. Imports of primary aluminum and aluminum alloys in 2008 decreased by 0.9% to 1,085,039 metric tons (t) from 1,190,456 t in 2007, of which 773,833 t was primary aluminum ingot and 311,206 t was primary aluminum alloys. The major suppliers of primary aluminum ingots and alloys were China (416,924 t, or 38.4% of the imported amount), Russia (262,271 t, or 24.2%), Australia (211,850 t, or 19.5%), South Africa (53,607 t, or 4.9%), and Canada (41,876 t, or 3.9%). Imports of scraps of aluminum and aluminum alloys increased by 7.6% to 503,154 t from 467,491 t in 2007. Domestic demand for and consumption of primary aluminum decreased by 10.8% to 963,812 t in 2008 from 1,080,620 t in 2007 (World Bureau of Metal Statistics, 2009, p. 26).

In June 2008, Novelis Korea Ltd. completed the installation of Novelis Fusion™ technology at its plant in Ulsan and began commercial production of multialloy aluminum sheet products. This was Novelis' second major investment in the Republic of Korea in the year after the completion of a $30 million expansion of its aluminum rolling mill in Yeongju. Novelis Fusion™ is a technology that produces aluminum sheet ingots with multiple layers of different alloys, which are then rolled into premium sheet products with previously unattainable combinations of attributes, such as high strength and superior surface quality. The initial opportunity for Novelis Fusion™ sheet products in the Korean marketplace was to replace the conventional clad aluminum products used in heat exchanger applications. Novelis Korea was a joint venture of Novelis (68%), Taihan Electric Wire Co. Ltd. (31%), and the Hyundai Group (1%) (Novelis Inc., 2009).

Cadmium.—Young Poong Corp. produced cadmium metal at the Sukpo refinery, and the reported cadmium metal production capacity was 805 metric tons per year (t/yr). Cadmium is mainly used in batteries (predominantly in rechargeable nickel-cadmium batteries); for cadmium pigments, coatings, and plating; and as stabilizers for plastics. Owing to the high toxicity of cadmium, which is associated with health and environmental problems, the use of cadmium was generally decreasing in all other applications (Young Poong Corp., 2009). Korea Zinc was a major domestic cadmium producer in the country with an annual production capacity of about 2,000 t at its refinery in Onsan.

Copper.—Mined production of copper was very small, and was insignificant compared with the country's requirements for copper ore and concentrate. The country's copper smelters were located in Changhang and Onsan, which produced about 390,000 t of blister and anode copper and about 573,000 t of refined copper. In 2008, the country increased imported copper ore and concentrates by 5.8% to 1,483,914 t from 1,402,886 t in 2007. It decreased imported blister and anode copper by 41.8% to 58,283 t from 100,129 t; decreased imported refined copper by 3.2% to 406,475 t from 419,792 t; and decreased imported copper and copper alloy scrap by 1.8% to 217,008 t from 221,054 t. The country's refined copper consumption decreased by 0.6% to 852,115 t from 857,647 t in 2007 (World Bureau of Metal Statistics, 2009, p. 73).

Gold.—The Republic of Korea produced 37,989 kilograms (kg) of refined gold in 2008, which was a decrease of 19.3% from the 47,078 kg produced in 2007; of this amount, 1,593 kg was from domestic raw materials, including scrap, compared with 3,098 kg in 2007, which was a decrease of 48.6%. The volume of imports of refined gold, which totaled 48,382 kg, decreased by 20.2% from the 60,610 kg imported in 2007; the value of exports decreased by 2.2% to $1,284.4 million from $1,312.6 million in 2007. Domestic demand for refined gold was 41,235 kg compared with 44,527 kg in 2007, which was a decrease of 7.4%. The volume of exports of refined gold, which totaled 46,391 kg, increased by 26.8% from the 36,574 kg exported in 2007; the value of exports increased by 87.2% to $1,270.8 million, from $678.9 million in 2007. The major end users of refined gold were the manufacturers of coins, dental products, electrical communication parts, jewelry, and materials for semiconductors (Ministry of Commerce, Industry and Energy, 2008, p. 9).

Korean gold producing companies exported mainly to Japan and other Asian countries. Domestic demand decreased by two-thirds compared with that of 2007 owing to the weakness of the industrial sector, and new customers from overseas were being developed gradually (Korea Zinc Co. Ltd., 2008).

The Muguk Mine was historically the Republic of Korea's leading gold producer, with recorded production of 8.15 t of gold mined between 1934 and 1972. Muguk was reopened between 1987 and 1998. In 1998, Muguk was reported by KORES to contain a combined resource of 1,418,980 t at a grade of 13.5 grams per metric ton (g/t) gold and 72.8 g/t silver (MOLY Investing News, 2008).

The Gasado project is an epithermal gold-silver deposit held under mining title on Gasado Island, which is located 5 kilometers (km) off the southwest coast of the Republic of Korea. Historical exploration by Indochina Goldfields indicated the existence of robust gold and silver mineralization between 4 and 7 meters (m) wide (MOLY Investing News, 2008).

Indium.—In 2008, the Republic of Korea exported 192.63 t of indium metal, powder, and scrap to Japan. This amount accounted for 65.8% of Japan's annual indium metal imports (Roskill Information Services Ltd., 2009b, p. 3).

The Republic of Korea Government had plans to stockpile a 60-day supply of indium to support domestic indium tin oxide (ITO) producers. This stockpile amount was equivalent to 22 t of indium, and of that amount, 11 t was already purchased; the rest would be purchased between March 2008 and March 2009. ITO's most notable feature is its combination of electrical conductivity and optical transparency; it is used mainly to make transparent conductive coatings and various optical coatings (especially infrared-reflecting coatings), and as a sensor coating (Roskill Information Services Ltd., 2009a, p. 15).

Iron and Steel.—In 2008, mine production of iron ore, in gross weight, increased by 25.8% to about 365,883 t from 290,802 t in 2007. Domestic iron ore was produced from the Sinyemi Mine. The Republic of Korea relied mainly on imports to meet its iron ore requirements in 2008. Imports of iron ore increased by 7.3% to 49,542,331 t from 46,176,285 t in 2007 and were valued at about $4.85 billion. The imported iron ore was mainly from Australia, Brazil, India, and South Africa; other suppliers of iron ore were Chile, Peru, and the United States. The average price of imported iron ore rose by 58.2% to $97.82 per metric ton from $61.85 per metric ton in 2007 (Ministry of Commerce, Industry and Energy, 2008, p. 9).

In 2008, the country's iron and steel industry consumed 48.65 Mt of iron ore and 28.1 Mt steel scrap. Crude steel production increased by 3.8% to 53.5 Mt from 51.52 Mt in 2007, of which 34.7 Mt (64.9%) was produced by POSCO; 9.9 Mt (18.5%), by Hyundai Steel Co. Ltd. (HSC); and the remaining 8.9 Mt (16.6%), by all other steel companies, among which were Dongkuk Steel Mill Co. Ltd., Korea Iron and Steel Co. Ltd., SeAH Besteel Corp., and Yamato Korea Steel Corp. The Republic of Korea was the world's sixth ranked steel-producing country and in 2008 its crude steel production was 4% of the world crude steel production. The country's two leading steelmakers—POSCO and HSC—were the world's 4th and 30th ranked steel-producing companies in 2008, respectively (Ministry of Commerce, Industry and Energy, 2008, p. 9; World Steel Association, 2009a-d).

According to the Korea Ministry of Commerce, the country's steel consumption increased by 1.8% to 48.65 Mt in 2008 from about 47.78 Mt in 2007 because of the increasing demand for steel in the manufacturing sector. Exports decreased by 49.9% to 4,971 t from 9,930 t in 2007 and the export value decreased by 55.0%, an amount equivalent to $254,000. The country's steel imports had exceeded its steel exports for six consecutive years owing mainly to a steady increase in domestic demand; steel imports from China especially had increased (Ministry of Commerce, Industry and Energy, 2008, p. 9).

HSC, which was formerly known as Hyundai INI Steel, and before that, Inchon Iron & Steel Co., Ltd., intended to increase its rebar output by about 213,000 t to more than 4 Mt. In 2008, many small domestic construction firms had suffered from a shortage of rebar as well as financial difficulties. HSC agreed with the Construction Association of Korea's (CAK) approach of helping some of the country's small construction companies and agreed to provide some 5,000 t of rebar to the companies at wholesale prices. Meanwhile, HSC switched its 10,000 metric tons per month of rebar exports to the domestic market, and the company raised its H-beam price by $48 per metric ton on July 1. The steel product price increases were caused by strong global demand for steel long products (Steel Insights, 2008). In July, HSC increased the price of its hot-rolled steel coils by 10.9% to $984 per metric ton in response to the increased cost of raw materials, especially the increased prices of pig iron, scrap iron, and Russian and Chinese slabs (South East Asian Trade, 2008). In August, HSC signed contracts with two Australian mining firms—Rio Tinto Ltd. and BHP Billiton Ltd.—to help HSC secure a stable supply of coal. The contract allowed HSC to buy 1 Mt of coal annually from Rio Tinto for the next 10 years and 1.6 Mt of coal annually from BHP Billiton for the next 5 years (Yonhap News Agency, 2009a).

As global economies experienced a significant slowdown, automakers and home appliance makers were making fewer cars and products, respectively, and the demand for and prices of steel dropped sharply in the second half of 2008. POSCO was forced to cut production of crude steel in December 2008 for the first time in its 41-year history. The company expected to cut production of crude steel in 2009 to 29.8 Mt, or by approximately 2 Mt (Zacks.com, 2009).

Lead.—Lead smelter production increased by 25.2% to 244,137 t from 195,022 t in 2007, and lead mine (Pb content) output increased significantly by 36 times to 449 t from 12 t in 2007. Korea Zinc Co. Ltd (Korea Zinc) produced 198,000 t of refined lead in 2008, which was 23,498 t more than was forecasted. The company's 2009 objectives included production of 200,000 t of refined lead; the sales forecast was conservative, however, owing to decreased base-metals prices on the London Metal Exchange (LME) (Korea Zinc Co. Ltd., 2009).

In November 2008, Korea Zinc signed a licensing agreement with Australia based Ausmelt Ltd. (AET) for the construction of two new Top Submerged Lance (TSL)-technology furnaces in Onsan for lead smelting. The new furnaces were expected to have the ability to recover lead from up to 70,000 t/yr of lead-bearing materials, including secondary lead (AZoM.com, 2008).

Molybdenum and Tungsten.—Canada-based Oriental Minerals Inc. was the only western exploration company with a diverse portfolio of precious and base-metals projects that was operating in the Republic of Korea. The company's projects included the Sangdong tungsten-molybdenum mine, which is located south of Seoul, and the Chongyang tungsten mine, which is located southeast of Seoul. Both tungsten and molybdenum prices had increased significantly during the past several years based on supply and demand, and made the reevaluation of these closed mines highly attractive (MOLY Investing News, 2008). On June 4, Oriental Minerals drilled an additional eight holes of the drill program at Sangdong (Oriental Minerals Inc., 2008d).

Nickel.—In 2008, the Republic of Korea imported 80,323 t of ferronickel (in gross weight), 16,985 t of refined nickel, 39,735 t of nickel oxide sinter (in gross weight), and 1,448 t of nickel powder and flake. The major suppliers of nickel oxide sinter, which contained 75% to 76% nickel, were Canada (43.8%), Australia (7.0%), and Japan (1.0%). The major suppliers of refined nickel were Australia (28.8%), Russia (22.5%), Canada (12.5%), and Norway (5.4%). The country exported 2,028 t of refined nickel and consumed smelter or refinery products containing of 73,317 t of nickel (World Bureau of Metal Statistics, 2009, p. 116).

Nickel was a critical input to the stainless steel industry and was one of the six strategic minerals identified by the Korean Government. POSCO and Société Minière du Sud Pacifique SA (SMSP) of New Caledonia jointly established the Nickel Mining Company (NMC) in New Caledonia and Société du Nickel de Nouvelle Calédonie et Corée (SNNC) in Korea. POSCO had a 49% stake in each company. On November 3, POSCO completed construction of the first ferronickel plant in the Republic of Korea. The SNNC plant, which was located at Gwangyang adjacent to the Gwangyang Steel Mill, was expected to help stabilize the country's supply of nickel. The new ferroalloy plant would refine nickel ore supplied from overseas and would have the capacity to process 30,000 t/yr of nickel in ferronickel. NMC was supplying all the nickel ore for the ferroalloy operation. The output of the Gwangyang ferronickel plant was expected to satisfy 68% of the annual nickel needs of POSCO's steelworks. SNNC supplied nickel to POSCO with a discount from the LME price. POSCO's investment of $172.5 million in New Caledonia nickel mines was intended to secure a 30-year supply of nickel ore. The SNNC Gwangyang ferronickel plant would process about 1.8 million metric tons per year of ore with an average ore grade of 2.27%. The cost of nickel accounts for 70% to 80% of the cost of making stainless steel; by producing its own nickel, POSCO would save a significant amount of money by not having to buy imported ferronickel or cathode (POSCO, 2008; Société Minière du Sud Pacifique SA, 2008).

Korea Nickel Corp. (KNC) was another leading producer of primary nickel in the Republic of Korea. KNC operated a standalone nickel refinery that produced finished nickel at its Onsan plant. KNC produced 28,653 Mt nickel in 2008, which was a 0.1% decrease from the 28,675 Mt produced in 2007 (Korea Zinc Co. Ltd., 2008).

Zinc.—ZincOx Resources plc. specialized in the low-cost recovery of high-grade zinc compounds from unconventional sources. In June 2008, ZincOx signed a memorandum of understanding with Korea Iron and Steel Association (KOSA), which was representing the steel industry in the Republic of Korea. KOSA assisted ZincOx in obtaining electric arc furnace dust (EAFD) supply commitments from various steel companies in the country, and together these companies generated approximately 380,000 t/yr of EAFD with a zinc grade of about 22% (ZincOx Resources Plc, 2009).

The Republic of Korea relied on imports for almost all the raw material requirements of its zinc-refining industry. In 2008, imports of zinc ore and concentrate, in gross weight, increased by 11.5% to 1,486,580 t from 1,333,481 t in 2007; the major suppliers were Peru, 454,927 t (or 30.6% of imports); Australia, 383,675 t (25.8% of imports); Russia, 201,022 t (13.5% of imports); Chile, 175,630 t (11.8% of imports); and Bolivia, 159,012 t (10.7% of imports). These imports contained about 743,290 t of zinc metal and were valued at about $1 billion. Exports of slab zinc increased by 20.7% to 310,672 t in 2008 from 257,314 t in 2007, The major destinations for zinc slab exports were Singapore, 52,723 t (or 17.0% of exports), Taiwan/China, 40,931 t (13.2% of exports); Indonesia, 38,177 t (12.3% of exports); Malaysia, 24,648 t (7.9% of exports); and Vietnam, 22,770 t (7.3% of exports). According to the Korea Institute of Geoscience & Mineral Resources (KIGAM), production of zinc slab decreased by 8.2% to 406,542 t from 443,051 t (revised) in 2007. Consumption of zinc ore and concentrate decreased by 3.1% to 1.35 Mt from the 1.39 Mt produced in 2007, and consumption of zinc slab decreased by 7.6% to 449,022 t from the 486,195 t produced in 2007. Mine production of zinc (Zn content) decreased by 9.7% to 3,672 t from 4,067 t (revised) in 2007 in response to the country's decreased demand for zinc ore and slab and the decrease in the price of zinc (table 1; Ministry of Commerce, Industry and Energy, 2008, p. 9; World Bureau of Metal Statistics, 2009, p. 143).

Young Poong Corp. established the Sukpo zinc refinery in Bongwhagun, Gyungsangbukdo, in 1970, and established a subsidiary—The Korea Zinc Co.—in Onsan, Gyungsangnamdo, in 1974. The continued expansion at the Sukpo refinery and the completion of the Onsan zinc refinery secured Young Poong's position in the domestic zinc market, and it emerged as a leading manufacturer of nonferrous metals. The corporation had an annual capacity to produce more than 303,000 t of zinc, including 280,000 t of zinc ingots at its zinc recycling facilities (Young Poong Corp., 2009).

Korea Zinc produced 445,000 t of refined zinc and maintained more than 79% of the domestic market share for zinc metal in 2008. The average price of zinc in 2008 was $1,875 per metric ton compared with $3,242 per metric ton in 2007. The decline in zinc prices followed the onset of the global financial crisis. Zinc consumption had progressively decreased because of reduced demand for zinc for galvanizing by steel manufacturers, and the significant cutback in zinc metal demand by the automotive, construction, and shipbuilding sectors. Korean's total production of zinc in 2008 increased by 5,390 t to 948,000 t, compared with 900,000 t (revised) in 2007 (Korea Zinc Co. Ltd., 2008).

Industrial Minerals

Cement.—According to the Xinhua News Agency in Beijing, the Ministry of Science and Technology Education of the Republic of Korea announced on November 4 that Korean scientists had invented a noncement concrete, which would help reduce greenhouse gas emissions. Korean's Yonhap News Agency reported the noncement concrete was produced by using blast furnace slag instead of cement and fine dust. Compared with ordinary concrete, noncement concrete was said to have better insulating ability, to weigh less, and to cost less to produce. The news agency suggested that it was expected to become the next competitive building material (Xinhua.com.cn, 2008).

Pyrophyllite.—Pyrophyllite was mined in two major areas in the Republic of Korea, both near the coast in the southern part of the peninsula. The largest volume of production was from the Wan-Do Mine in the Haenam area. Some of the major mines in the Haenam area were the Chin-Do, the Dae-Do, the Hwansan, the Okmesan, and the Sungsan Mines. The second major pyrophyllite-producing area was at Dong-Nae where the Kimhae, the Kyong-Nam, the Nilyang, the Pusan, and the Yangsan Mines were worked (Kennedy, 1990, p. 231-232).

Mineral Fuels and Related Materials

Coal.—According to the trade statistics of the Republic of Korea, the country's coal imports in 2008 increased by 12.8% to 99,584,479 t, which was an increase of 11,300,424 t from the 88,284,056 t produced in 2007. Imports from Australia amounted to 38,203,000 t and accounted for 38% of total imports. The average cost, insurance, and freight (CIF) import price increased by 74.6%, to $124.11 from $71.10 in 2007. Coal imports included about 73,957,727 t of thermal coal, about 19,671,484 t of metallurgical coal, and about 5,955,268 t of anthracite, which represented increases of 12.8%, 13.9%, and 9.4%, respectively. The country also imported 683,850 t of coal coke, which was a decrease of 8.2% from the 744,977 t imported in 2007; more than 90% of the coal coke was imported from China. These imports were used mainly to meet the country's overall coal requirements for general consumption and for industrial use in the cement, electric power, and iron and steel industries. In 2008, the major suppliers of imported coal were Australia (38,202,892 t), Indonesia (26,551,364 t), the Republic of China (17,876,980 t), Russia (7,495,910 t), Canada (6,521,453 t), Vietnam (1,207,455 t), and the United States (1,041,119 t). The Republic of Korea exported 112,799 t of green petroleum coke, which was a decrease of 45.6% from the 94,647 t exported in 2007; exports by destination included 95,000 t to Japan and 18,000 t to China (TEX Report, The, 2009b).

As of December 31, 2008, the Republic of Korea's electric power capacity from coal-burning thermal power stations increased by 15.8% to 23,705 megawatts (MW), which included 1,125 MW at anthracite-burning stations and 22,580 MW at bituminous-coal-burning stations. The significant increase in the capacity of bituminous coal-burning thermal power stations was based on the startup of the Boryeong No. 7 unit of Korea Midland Power (KOMIPO) and the Yonghung No. 3 unit of Korea South-East Power (KOSEP) in June; and the startup of the Boryong No. 8 unit of KOMIPO, the Hadong No. 7 unit of Korea South Power (KOSPO), and the Yonghung No. 4 unit of KOSEP in December. The output capacities of the new units would be 500,000 kilowatts (kW) each at the Boryeong No. 7 and No. 8 units and the Hadong No. 7 unit; and 870,000 kW each at the Yonghung No. 3 and No. 4 units. As a result, coal consumption by the country's electric utilities in 2008 increased by 11.9% to 65,280,000 t (TEX Report, The, 2009c).

According to statistics released by the Ministry of Commerce, Industry and Energy of the Republic of Korea, the country's consumption of bituminous coal in 2008 was 93,983,000 t, which included 23,568,000 t of metallurgical coal and 70,415,000 t of thermal coal. The country's consumption of anthracite was 10,217,000 t, which included 4,134,000 t of domestic coal and 6,083,000 t of imported coal (TEX Report, The, 2009a).

Natural Gas and Petroleum.—S-Oil Corp., which was headquartered in Seoul, produced petroleum and lubricant products and exported more than 60% of its petroleum and petrochemical products. In 2008, S-Oil pushed forward the Alkylation project and the Onsan refinery expansion project. The company invested $19 million (178 billion won) in building a new alkylation facility from 2007 to 2009. It selected Exxon Mobil Corp.'s PxMax® technology to replace a nonselective toluene disproportionate process (TDP) at the Onsan refinery (Exxon Mobil Corp., 2007; Reuters, 2007; S-Oil Corp., 2009). In March, S-Oil and France's Total S.A. signed an agreement to form a 50-50 joint venture, named S-Oil Total Lubricants Co. Ltd. (STLC), which would combine S-Oil's lubricant business division and Total's lubricant subsidiary in the Republic of Korea; STLC would be managed jointly by S-Oil and Total. The new joint venture would have a blending capacity of about 140,000 t/yr in two of Onsan plants—one from Isu Chemicals of Total and another from S-Oil. STLC was expected to combine the two plants into a single site along with the Onsan refinery expansion project; the complex would be expanded to a capacity of more than 2,500 barrels per day by 2009 and would become a leading company on the domestic lubricant market (Gill, 2008; OEM/Lube News, 2008).

Uranium.—Oriental Minerals was conducting two uranium projects in the Republic of Korea—the Dongjeum uranium project and the Ogcheon uranium project. Oriental Minerals had applied for mining rights to four areas covering 11.04 square kilometers (km^2) of the Dongjeum uranium prospect; it had also applied for uranium and thorium mining rights for a total of 397.4 km^2 at Ogcheon (MOLY Investing News, 2008).

On May 28, 2008, KORES had agreed to fund Stage 1 drilling that would target part of Oriental Mineral's Ogcheon uranium project. Stage 1 drilling would consist of a 5-hole, 800-m drill program; Oriental Minerals and KORES would choose the hole locations jointly, and KORES would bear the drilling cost. The 800-m Stage 1 program was part of Oriental Minerals' previously announced 6-km diamond drill program (Oriental Minerals Inc., 2008a).

On July 9th, 2008, Oriental Minerals was granted three uranium exploration and mining licenses known as Daejeon 80 (Reg. No. 77073), Geumsan 81 (Reg. No. 77072), and Goisan 116 (Reg. No. 77074) in the Ogcheon region (Oriental Minerals Inc., 2008b, c).

Outlook

The International Monetary Fund forecasted that the 2009 projections for economic growth of the Republic of Korea would be reduced by about 4% compared with that of 2008 because of the worldwide economic downturn (NASDAQ Stock Market, Inc., The, 2009). As the mining sector accounted for only a minimal portion of the country's GDP in 2008 and because the country relies heavily on imports of raw materials, the Republic of Korea is not expected to be as affected as some other countries by the global decline of the mineral industry. However, there were several uncertain factors that could have a negative effect on the economy, such as the North Korea nuclear issue, the decrease in domestic industrial demand; commodity price and globe monetary exchange rate fluctuations, unemployment, and so forth. The country will most likely continue its commodity stockpile program; investing in Africa, the Middle East, and South America; and implementing its economic and diplomatic strategy to secure its supply of mineral resources.

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TABLE 1
REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	2004	2005	2006	2007	2008
METALS					
Bismuth, metal	156	231	236	267	210
Cadmium, smelter	2,362	2,582	3,320	2,846	3,090
Copper:					
Mine output, Cu content	2	4	3	6 [r]	4
Metal:					
Smelter, primary and secondary	442,500	486,500	484,000	515,000	544,000
Refined, primary and secondary	496,000	519,300	575,500	566,400 [r]	514,243
Gold:					
Mine output, Au content kilograms	233	266	277	162	175
Metal, refined do.	32,449	42,485	43,505	47,078	37,989
Iron and steel:					
Iron ore and concentrate:					
Gross weight thousand metric tons	226	213	227	291	366
Fe content do.	127	119	155	163	205 [e]
Metal:					
Pig iron do.	27,556	27,309	27,548	29,437	31,043
Ferroalloys:					
Ferromanganese	165,525	124,000	169,202	209,321	251,125
Ferrosilicomanganese	82,917	74,000	94,119	105,607	76,184
Total	248,442	198,000	263,321	314,928	327,309
Steel, crude thousand metric tons	47,521	47,820	48,455	51,517	53,322
Lead:					
Mine output, Pb content	40	50	17	12	449
Metal, smelter	173,609	180,784	163,379	195,022	244,137
Nickel:					
Ferronickel	--	--	--	--	2,506
Metal	27,200	26,300	28,085 [r]	28,675 [r]	28,653
Silver:					
Mine output, Ag content kilograms	5,059	3,515	1,521	1,400 [e]	1,462
Metal do.	1,172,632	1,218,849	1,377,659	1,393,935	1,461,886
Zinc:					
Mine output, Zn content	14	77	16	4,067 [r]	3,672
Metal, primary	668,666	644,828	870,000 [r]	900,000 [r]	948,000
INDUSTRIAL MINERALS					
Barite	50	--	--	--	--
Cement, hydraulic thousand metric tons	56,955	51,391	53,971	52,182 [r]	51,653
Clays, kaolin do.	2,780	2,767	2,399	688 [r]	955
Diatomaceous earth	2,441	2,193	3,460	2,360	2,540
Feldspar	541,788	508,644	427,378	398,513	344,257
Graphite, all types	247	39	68	52	73
Lime, slaked lime[e]	3,574,000 [2]	3,600,000	3,600,000	3,600,000	3,600,000
Mica, all grades	59,238	36,623	30,356	42,385	49,474
Nitrogen, N content of ammonia	163,400	165,000 [e]	90,000 [e]	-- [r]	--

See footnotes at end of table.

TABLE 1—Continued
REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
INDUSTRIAL MINERALS—Continued						
Salt		340,828	378,887	285,568	249,515	384,304
Soda ash, manufactured[e]		310,000	310,000	310,000	310,000	310,000
Stone, sand and gravel:						
Limestone	thousand metric tons	87,881	81,432	79,404	82,655 [r]	82,254
Quartzite	do.	2,842	2,868	2,921	3,511	3,325
Sand, including glass sand	do.	554	461	1,437	22,227 [r]	1,757
Sulfur, byproduct:[e]						
Metallurgy	do.	796	800	660	670	660
Petroleum	do.	879	900	950	1,000	900
Total	do.	1,680 [r]	1,700	1,610	1,670	1,560
Talc and related materials:						
Pyrophyllite		827,895	885,559	677,465	798,054	892,625
Talc		79,313	83,471	64,118	9,557	6,438
Zeolites		142,401	173,435	160,056	157,408	217,691
MINERAL FUELS AND RELATED MATERIALS						
Carbon black		473,788	471,716	484,302	497,191	484,000 [e]
Coal, anthracite	thousand metric tons	3,191	2,832	2,824	2,886	2,773
Fuel briquets, anthracite briquets	do.	1,385	2,010	2,327	2,400 [e]	2,320 [e]
Petroleum, refinery products[3]	thousand 42-gallon barrels	695,652	727,234	717,493	770,523 [r]	747,827

[e] Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r] Revised. do. Ditto. -- Zero.

[1] Table includes data available through September 30, 2009.

[2] Reported figure.

[3] Includes bunker oil C-type, diesel oil, gasoline, kerosene, LPG, and naphtha.

Sources: Ministry of Commerce, Industry and Energy, Korea Institute of Geoscience and Mineral Resources, 2008 supply and demand balance by mineral, p. 9; U.S. Geological Survey Minerals Questionnaire 2004-08; World Bureau of Metal Statistics, May 2009; The Bank of Korea Monthly Statistical Bulletin, Table 41, Exports by principal commodity, and Table 42, Imports by principal commodity, February 2009, p. 130-131.

TABLE 2
REPUBLIC OF KOREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bismuth, metal	metric tons	Korea Zinc Co. Ltd.	Onsan refinery	100
Cadmium	do.	do.	do.	2,000
Do.	do.	Young Poong Corp.	Sukpo refinery	805
Cement		Ssangyong Cement Industrial Co. Ltd.	Plants at Tonghae, Kwang Yang, Munkyung, Pukpyong, and Yeongwol	15,040
Do.		Sung Shin Cement Manufacturing Co. Ltd.	Tanyang plant	13,700
Do.		Tong Yang Major Corp.	Plants at Pukpyong and Samchok	11,580
Do.		Lafarge Halla Cement Corp.	Plants at Kwang Yang and Okkye	9,500
Do.		Hyundai Cement Co. Ltd.	Plants at Tanyang and Yongwol	8,600
Do.		Hanil Cement Manufacturing Co.	Plants at Chungbuk and Tanyang	7,200
Do.		Asia Cement Manufacturing Co. Ltd.	Plants at Daegu and Jaechon	4,600
Coal		Korea Coal Corp.	Mines at Changsung, Dogae, and Hwasoon	2,000
Copper, metal, primary		Korea Zinc Co. Ltd.	Onsan	20
Do.		LS-Nikko Copper Inc.	Changhang	60
Do.		do.	Onsan	510
Gas, natural		Korea National Oil Corp. (KNOC)	Ulleung Basin	NA
Gold:				
In concentrate	kilograms	Hangum Co. Ltd.	Haenam, Cholla Province; Muguk Mine	1,600
Refined	do.	Korea Zinc Co. Ltd.	Onsan	50,000
Do.	do.	LS-Nikko Copper Inc.	do.	60,000
Graphite		Kaerion Graphite Ltd.	Kangwon	NA
Do.		Wolmyong Mining Co.	do.	NA
Indium, metal	kilograms	Korea Zinc Co. Ltd.	do.	55,000
Iron Ore		NA	Mines at Sinyemi, Gangwon-do Province	300
Lead, metal, primary		Korea Zinc Co. Ltd.	Kangwon	200
Molybdenum	metric tons	Korea Resources Corp. (KORES)	Mine at Uljin; Smelter at Yeosu, South Jeolla Province	6,000
Nickel:				
Metal		Korea Nickel Corp.	Onsan nickel refinery plant	48
Ferronickel		POSCO	Gwangyang ferronickel plant	30
Petroleum, refinery products	thousand 42-gallon barrels per day	SK Corp.	Ulsan	817
Do.	do.	LG-Caltex Corp.	Yocheon (Yosu)	650
Do.	do.	Hyundai Oil Refinery Co.	Daesan and Inchon	589
Do.	do.	S-Oil Corp.	Onsan	520
Pyrophyllite		NA	Wan-Do, Sungsan, Hwansan, Okmesan, Dae-Do, and Chin-Do Mines in Haenam	446
Do.		NA	Nilyang, Yangsan, Kimhae, Pusan, and Kyong-Nam Mines in Dong-Nae	446
Silver:				
In concentrate	kilograms	Hangum Co. Ltd.	Haenam, Cholla Province	3,700
Refined	metric tons	Korea Zinc Co. Ltd.	Onsan	1,000
Do.	do.	LS-Nikko Copper Inc.	do.	370
Steel, crude		Pohang Iron and Steel Co. Ltd.	Kwangyang (Gwangyang) Works	15,000
Do.		do.	Pohang Works	13,000
Do.		Hyundai Steel Co. Ltd. (HSC)	Inchon Plant	4,800
Do.		do.	Pohang Plant	3,200
Do.		Dongkuk Steel Mill Co. Ltd.	Inchon Works	1,450
Do.		do.	Pohang Works	3,600
Do.		Korea Iron and Steel Co. Ltd.	Masan and Changwon Works	1,200
Talc		IL Shin Industrial Co. Ltd.	Choong Ju, Chungcheongbuk Province	160
Do.		Korea Zinc Co. Ltd.	Onsan	430
Do.		Young Poong Corp.	Sukpo	280
Zinc		Korea Zinc Co. Ltd.	Onsan refinery	445
Do.		Young Poong Corp.	Sukpo refinery	303

NA Not available. Do., do., Ditto

THE MINERAL INDUSTRY OF LAOS

By Yolanda Fong-Sam

Laos has a variety of undeveloped mineral resources. The Government recognizes mining as a critical sector of the economy and supports development of the sector by promoting local and foreign investment. Under the Laotian Mining Law, which was established in 1997, and the Implementing Decree of 2002, all mineral resources within the country's territory, including those on the surface, underground, and offshore, are the property of the national community and subject to the management of the state. The Department of Geology and Mines was restructured in 2006 to form the Department of Geology and the Department of Mines as the two Government agencies that oversee the Mining Law, which includes inspecting and monitoring mineral development activities in the country. Both agencies also assist in the negotiation of mining contracts, mineral exploration, and mining licensing activities; promote investment in the mining sector; maintain geologic databases, and provide mineral exploration support and data analysis studies (Department of Geology and Mines of Laos PDR, 2010a, b).

In 2008, Laos' mineral production included refined copper, gold, and silver, of which production increased by 2.5%, 3.3%, and 33%, respectively, compared with that of 2007 (table 1). Oxiana Ltd. of Australia, through its wholly owned Lane Xang Minerals Ltd. (LXML), produced copper, gold, and silver from its Sepon copper-gold project. In July 2008, Oxiana merged with Zinifex Ltd. to form OZ Minerals Ltd. The Laotian Government held a 10% interest in the Sepon project, which is located 40 kilometers (km) north of the town of Sepon in Savannakhet Province in the south-central region of the country. In 2008, the Sepon project produced more than 64,000 metric tons (t) of copper cathodes and nearly 3,000 kilograms (kg) of gold (Minerals and Metals Group, 2008; OZ Minerals Ltd., 2008, p. 2, 12, 63).

PanAust Ltd. of Australia, through its Lao-registered company Phu Bia Mining Ltd. (PBM), owned 90% interest in the Phu Kham copper-gold operation; the Government of Laos owned the remaining 10%. In April 2008, the Phu Kham operation started production of copper and gold concentrate; the property also included a heap-leach operation (PanAust Ltd., 2009a).

The Phu Kham copper-gold deposit is located approximately 120 km north of the capital city of Vientiane. The mine was projected to begin processing 12 million metric tons per year (Mt/yr) of ore in 2009; the ore would contain approximately 53,000 t of copper, between 1,500 and 1,700 kg of gold, and between 9,000 and 12,000 kg of silver. PanAust was projected to complete an expansion project to increase the mine's processing capacity to 16 Mt/yr of ore by 2012 (PanAust Ltd., 2009b).

Outlook

In 2009, Laos's mineral production will most likely be dominated by the production of copper, gold, and silver. Increases in production will be dependent on the performance of the projects that started in the country recently, and by the exploration activities carried out by companies operating in Laos.

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TABLE 1
LAOS: PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006[e]	2007[e]	2008[e]
Barite		10,470	28,500	29,000	29,000	29,000
Cement[e]		250,000	250,000	400,000	400,000	400,000
Clay		58,718	8,155	5,200	5,500	5,500
Coal, lignite		332,907	232,934	233,000	620,000	600,000
Copper:						
Mine output, Cu content		--	39,943	89,092 [3]	99,040 [3]	100,000
Metal, refined		--	30,480	60,803 [3]	62,541 [3]	64,100
Gemstones, sapphire	carats	712,320	1,180,000 [e]	1,200,000	1,200,000	1,200,000
Gold	kilograms	6,760	7,058	6,088 [3]	4,161 [3]	4,300
Gravel		40,000	97,400	100,000	120,000	120,000
Gypsum		201,094	774,000 [e]	775,000	775,000	775,000
Limestone[e]		518,000	750,000	750,000	750,000	750,000
Salt, rock		15,000	34,139	35,000	35,000	35,000
Sand, construction materials		98,900	85,300	90,000	100,000	100,000
Silver	kilograms	2,735	3,405	6,331 [3]	4,500 [3]	6,000
Tin, mine output, Sn content[e]		400	450	450	700 [r]	700
Zinc, mine output, Zn content[e]		950	3,410	1,100	1,100	1,100

[e] Estimated; estimated data are rounded to no more than three significant digits. [r] Revised. -- Zero.

[1] Table includes data available through March 4, 2010.

[2] In addition to the commodities listed, crude construction materials, such as sand and gravel, and varieties of stone were produced irregularly.

[3] Reported figure.

Sources: Laos' Ministry of Industry and Handicraft, Lao PDR 2004 Minerals Yearbook; U.S. Geological Survey Minerals Questionnaire for Laos (2002-07); Oxiana Ltd. Annual Reports 2005-08 and Quarterly Reports 2005-07; Pan Australian Resources Ltd., Annual Report 2008 and Quarterly Reports 2005-07; World Metal Statistics, 2009

TABLE 2
LAOS: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Barite		Barite Mining Co., Inthavong Mining Co., Lao Development Construction Co., Phethongkham Co., Oravan Barite Co., and Singphooufar Co.	Muongfuong and Sanakham, Vientiane Province	30,000 [1]
Cement		Wanrong Cement I	Vangvieng, Vientiane Province	78,000
Do.		Wanrong Cement II (Yuannan Industrial Economic Co., 60%, and Agricultural and Forestry Development and Service Co. of Laos, 40%)	do.	200,000
Do.		Wanrong Cement III	Savannakhet Province	200,000
Coal:				
Anthracite		Agriculture Industry Development Enterprises	do.	60,000
Lignite		Viengphoukha Coal Mine Co. Ltd.	Viengphoukha, Luangnamtha Province	300,000
Copper:				
Mined ore output, Cu content		Lane Xang Minerals Ltd. (LXML) (wholly owned subsidiary of Oxiana Ltd.)	Sepon, Vilabouly District, Savannakhet Province	67,600
Refined		do.	do.	63,000
Do.		Phu Bia Mining Ltd. (PBM) [wholly owned subsidiary of PanAust Ltd.]	Xaisomboun special zone, 120 kilometers northeast of Vientiane, Vientiane Province	53,000
Gemstone (sapphire)	carats	Bokeo Mining Co. Ltd.	Bokeo Province	300,000
Do.	do.	Buhae Industrial Corp.	Houaxay District, Bokeo Province	500,000
Do.	do.	Lao International Trade and Service	do.	400,000
Gold, mine output, Au content	kilograms	Lane Xang Minerals Ltd. (wholly owned subsidiary of Oxiana Ltd.)	Sepon, Vilabouly District, Savannakhet Province	7,500
Do.	do.	Phu Bia Mining Ltd. (PBM) [wholly owned subsidiary of PanAust Ltd.]	Xaisomboun special zone, 120 kilometers northeast of Vientiane, Vientiane Province	1,700
Gypsum		Lao State Gypsum Mining Co. Ltd.	Champhon District, Savannakhet Province	200,000
Do.		Mining Development Economy Cooperation (OEDCD)	Tha Kect District, Khammouane Province	150,000
Do.		Savan Gypsum Mining Co. Ltd.	Champhon District, Savannakhet Province	70,000
Do.		LAVICO Co. Ltd. (a Laos-Vietnam joint venture)	Xebangfay District, Khammouane Province	100,000
Limestone		Laos Cement Co. Ltd. (a Laos-China joint venture)	Vangvieng, Vientiane Province	250,000
Do.		Agricuture Industry Development Enterprises	do.	150,000
Do.		V.S.K. Co. Ltd.	Tha Kect District, Khammouane Province	150,000
Do.		Phanangnon Co. Ltd.	do.	100,000
Silver	kilograms	Phu Bia Mining Ltd. (PBM) [wholly owned subsidiary of PanAust Ltd.]	Xaisomboun special zone, 120 kilometers northeast of Vientiane, Vientiane Province	12,000
Tin, mine output, Sn content		Lao-North Korea Tin Mines	Hinboune District, Khammouane Province	120
Do.		S V Mining Co. Ltd.	do.	300
Zinc, mine output, Zn content		Padeang Industry Public (Laos) Co. Ltd. [Majority interest owned by Padeang Industry (Public) Co. Ltd., and minority interest owned by the Government of Laos]	Kaiso, Vangvieng, Vientiane Province	1,100

[e] Estimated; estimated data are round to no more than three significant digits. Do., do. Ditto.

[1] Estimated combined capacity of the six local barite mining companies.

THE MINERAL INDUSTRY OF MALAYSIA

By Pui-Kwan Tse

Malaysia's economy was dependent on exports of manufactured goods and the service sector. As the global financial crisis spread throughout the world during the second half of 2008, Malaysia's exports decreased and industrial output declined. The contraction in exports affected the domestic demand. Private investment and consumption slowed down significantly; however, public investment and consumption remained moderate in the fourth quarter of 2008. Overall, the Malaysian economy registered a growth of 4.6% in 2008 compared with 6.3% in 2007 (Bank Negara Malaysia, 2009, p. 6-7).

Minerals in the National Economy

Malaysia's identified mineral resources were barite, bauxite, clays, coal, copper, gold, natural gas, ilmenite, iron ore, monazite, petroleum, silica, silver, struverite, tin, and zircon. During the 20th century, mineral production played an important role in Malaysia's national economy; after many years of exploitation, such minerals as barite, bauxite, copper, ilmenite, iron ore, and tin were either depleted or the capacities to produce them had decreased significantly in recent years. In terms of contributing to the country's economy, the share of the mining and quarrying sector accounted for only 17.2% of the gross domestic product in 2008 because of a decrease in the production of natural gas and oil and decreased output from the mining and quarrying sector during the fourth quarter of 2008. Owing to new infrastructure projects called for in the Ninth Malaysia Plan, the growth of the construction sector increased by 2.1% in 2008. Because of the global financial crisis, the output of the mining and manufacturing sectors was expected to decrease in 2009 (Minerals and Geoscience Department, 2008, p. 1; Department of Statistics, 2009a).

Government Policies and Programs

In Malaysia, the mineral activities are governed by the Mineral Development Act 1994 and the State Mineral Enactment. The Mineral Development Act 1994 defines the power of the Federal Government to regulate and conduct inspections of the mineral exploration, mining, and related activities. The State Mineral Enactment gives the States the power to issue mineral prospecting and exploration licenses and mining leases. As of yearend 2008, the States of Kelantan, Pahang, Perak, Sabah, Selangor, and Terengganu had adopted and implemented the quarry rules outlined in section 14 of the National Land Code 1965, which regulates quarrying activities for "rock mineral" in peninsular Malaysia. The Government defines rock mineral as clay, granite, gravel, limestone, marble, peat, rock, sand, stone, and other related manufactured commodities. The Petroleum Mining Act 1966 regulates petroleum activities in Malaysia.

The prices of petroleum products in Malaysia were among the lowest in Asia because the Government fixed the price below market rates and paid subsidies to fuel retailers as compensation. Fuel subsidies were a significant part of the Government budget. The Government decided to stop paying subsidies when crude oil was $65 per barrel or lower and planned to set floor prices for petroleum products. During the first 10 months of 2008, the Government provided $4.7 billion in subsidies (Star, The, 2008b).

Production

Malaysia produced bauxite, coal, feldspar, gold, ilmenite, iron ore, mica, natural gas, petroleum, tin, and zircon. Malaysia had been one of the major tin producing countries in the world; owing to depleted ore resources and lower ore grades, however, tin concentrate production had decreased in recent years. The country depended on imported tin concentrates and crude tin mainly from Australia and Indonesia to meet its demand for feedstocks for its smelter and refinery. In 2008, production of such commodities as mined tin and tin metal increased by more than 10% whereas gold production decreased by more than 10% (table 1).

Structure of the Mineral Industry

Malaysia's mineral industry consisted of a small mining sector of coal and ferrous and nonferrous metals. Metallic and nonmetallic processing facilities were operated by private companies incorporated in Malaysia. Oil and gas exploration, production, and processing activities were owned and operated by Petroliam Nasional Berhad (Petronas), which was a state-owned company, and by joint ventures of Petronas and foreign companies (table 2).

Mineral Trade

The major export products were automotive parts, chemicals, electronics, and machinery. The volume of mineral commodity exports had declined in recent years. In 2008, the total trade increased to $355.5 billion; of that amount, exports increased by 9.6% to $199.0 billion and imports increased by 3.3% to $156.5 billion. Electrical and electronic products continued to be Malaysia's leading export category and accounted for 38.5% of the total exports. Owing to higher prices on the world markets, the country's crude oil export revenue increased by 30.1% to $12.9 billion; however, its export volume decreased by 4.3% to 16.2 million metric tons (Mt). As a result of the higher price of liquefied natural gas (LNG), the export revenue from LNG increased by 55.7% to $12.2 billion and the export volume increased by 0.9% to 22.9 Mt. LNG was exported mainly to China, Japan, and the Republic of Korea (Department of Statistics, 2009b).

Commodity Review

Metals

Aluminum.—Malaysia did not have an aluminum refinery or smelter; most of its bauxite output, therefore, was exported to China, and Malaysia imported unwrought aluminum to meet its demand. The Government gave its approval for Sarawak Aluminium Co. (SALCO), which was a joint venture between Malaysian Cahya Mata Sarawak Berhad (CMS) and Rio Tinto Alcan (a subsidiary of Rio Tinto Ltd. of Australia), to build an aluminum smelter in Similajau, which is located about 60 kilometers (km) from the town of Bintulu in the State of Sarawak. The joint venture signed a memorandum of understanding with Sarawak Energy Berhad to supply power for the SALCO smelter. Rio Tinto Alcan was to install the Pechiney (AP) 37 aluminum smelting technology for the SALCO smelter. Initial aluminum output capacity was increased to 720,000 metric tons per year (t/yr) instead of the earlier planned capacity of 550,000 t/yr; capacity would eventually be expanded to 1.5 million metric tons per year (Mt/yr). The company would process aluminum into products, such as cables and semimanufactured products for the domestic and export markets. The total investment of the aluminum project was expected to be twice the previously planned $2 billion because of the larger facility and the increased cost of materials. The construction of the smelter was scheduled to begin in early 2009. The smelter was expected to commence operations by the fourth quarter of 2010 and to reach full production in 2011. Raw material (alumina) would be imported from the Yarwun Alumina Refinery in Gladstone, Australia (NST Business Times, 2008; Rio Tinto Ltd., 2008).

Press Metal Sarawak Sdn Bhd, in which Press Metal Berhad held an 80% equity share, started the construction of its aluminum smelter in Mukah in the State of Sarawak in 2008. Press Metal had chosen the Aluminum Corp. of China Ltd. (Chalco) as its technical partner for the $770 million aluminum smelter project. The Chalco's Guiyang Aluminum and Magnesium Research Institute would install the GY-200 aluminum smelting technology, which was equipped with 208 210-kiloampere prebaked cells. The initial output capacity was 50,000 t/yr and the smelter was scheduled to start up in mid-2009. When development of the Mukah smelter is completed, the smelter would have a total output capacity of 300,000 t/yr. The company signed a memorandum of understanding with Sarawak Energy Berhad to supply 510 megawatts of electricity generating capacity for the smelter by 2010 (China Metal Bulletin, 2009).

Gold.—Malaysia's gold was produced mainly from the Penjom Mine in the State of Pahang. The Penjom Mine was operated by Specific Resources Malaysia Sdn. Bhd., which was a wholly owned subsidiary of Avocet Mining plc of the United Kingdom. The company replaced smaller contractor trucks with larger, more-fuel-efficient equipment that was capable of supporting a higher mining rate and changed from a ball mill operation to a semiautogenous mill operation. The operation's capacity was increased by 25%. The company also changed from a conventional gravity and carbon-in-leach process to a complex gravity circuit and resin-in-leach process. The recovery rate had greatly improved for highly carbonaceous gold ore, such as that mined at the Penjom Mine. The changes would allow the company to increase the mining and plant throughput and to exploit lower grade ore. The ore grade at the bottom of the Kalampong pit was lower than expected, and the company switched its mining activity to the southern areas, including Janik and Manik. The volume of the mined ore was increased by 20% but the ore grade was 3.47 grams per metric ton (g/t) gold and the recovery rate fell to 86%. As a result, gold production was 18% lower in 2008 than in 2007 (Avocet Mining plc, 2009, p. 16).

Peninsular Gold Ltd. of the United Kingdom, through its subsidiary, Raub Australian Gold Mining Sdn. Bhd., conducted a gold development project at Raub in the State of Pahang. The area around Raub had been the site of extensive gold mining in the past. The company identified 6.3 metric tons (t) (202,000 troy ounces) of gold in the tailings and expected that more gold would be found in the area. A 1-Mt/yr carbon-in-leach processing plant was built to recover gold from the tailings and was scheduled to begin operating in early 2009. The company had another gold project, Tersang, which was located a short distance from Raub and which had identified 16 t (528,000 troy ounces) of gold resources (Peninsular Gold Ltd., 2008).

Zedex Minerals Ltd. of New Zealand signed an agreement with Gladioli Enterprises Sdn Bhd. to earn a 50.05% share in the Bau gold project. The Bau project is located in the township of Bau about 37 km from the capital city, Kuching, in the State of Sarawak. The exploration area was about 828 square kilometers. The Bau area had been an important mining center during the 20th century. Exploration results indicated that in the exploration area and at the mine tailings of three deposits—Jugan, Pejiru, and Sirenggok—there was a total of 50.1 t (1,612,000 troy ounces) of gold resources. Zedex planned to review previous exploration data and to undertake further drilling to confirm the validity of existing data (Zedex Minerals Ltd., 2009, p. 7).

Iron and Steel.—Malaysia produced a small amount of low-grade iron ore from the States of Pahang, Perak, and Terengganu. Some domestic iron ore output was consumed by domestic pipe-coating plants and cement plants, however, and most of the iron ore (547,457 t) was exported to China in 2007 (the latest year for which data were available). In the same year, the country imported a total of 2.45 Mt of high-grade iron ore from, in descending order of amount received, Brazil, Chile, Mexico, and Bahrain. The country imported a total of 518,379 t of pig iron and 8.8 Mt of iron and steel scrap for steelmaking; one-half of these imports was from the United States (Minerals and Geoscience Department, 2008, p. 27-31).

Owing to the global financial crisis and slow demand for steel products in several developed countries, some Malaysian steel producers reduced their production by 35% during the last quarter of 2008. In 2008, Malaysia's steel products consumption decreased to 7.8 Mt from 8.9 Mt in 2007 owing to the slow demand for long- and flat-steel products by the construction sector. Under the Ninth Malaysia Plan, the Government planned to invest $12.8 billion for infrastructure projects, and steel products consumption was expected to increase during the next 2 years (Southeast Asia Iron and Steel Institute, 2009).

Malaysia's leading iron and steel producer, Lion Group, through its subsidiary Lion Diversified Holdings Bhd, planned to build an ironmaking plant in Banting. Wisdri Engineering and Research Incorporation Ltd. (formerly Wuhan Iron and Steel Design and Research General Incorporation) of China was awarded the contract to design and build the blast furnace. The volume of the blast furnace would be 2,580 cubic meters with an output capacity of 2.5 Mt/yr of pig iron. Beijing Shougang International Engineering Technology Co. Ltd. of China was awarded the contract to build a 2.2-Mt/yr coke oven and a 2.8-Mt/yr sinter plant. The total investment was estimated to be $500 million. The company also planned to install a 1.6-Mt/yr-capacity LD converter, ladle furnace, vacuum oxygen degasser, and slab caster at its steel complex in Banting. The construction of the ironmaking plant was scheduled to be completed at the end of 2009. The steelmaking output at the Banting iron and steel complex would increase to 6.5 Mt/yr from 3.3 Mt/yr in 2007. Iron ore imports would be sourced from Australia where the Group had investment in an iron ore mine (Lion Group, The, 2008).

Ann Joo Steel Bhd. (a subsidiary of Ann Joo Group) renovated its electric arc furnace to increase its steelmaking output capacity to 900,000 t/yr in 2008. In late 2007, Ann Joo awarded a contract to China's Tangshan Iron and Steel Design and Research Institute to design and build a 450-cubic-meter blast furnace and a 75-square-meter sinter machine at its plant site. The blast furnace, which would have pig iron output capacity of 500,000 t/yr, was scheduled to be put into operation in December 2008. However, owing to the global financial crisis and technical problems, startup of the blast furnace was postponed until the second quarter of 2010. Ann Joo also planned to expand the pig iron output capacity to 1.1 Mt/yr through the addition of another blast furnace, a sinter machine, and a 45-t converter under a second-phase expansion (Midf Amanah Investment Bank Berhad, 2009).

Rare Earths.—Globally, the production and resources of rare earths were dominated by China. Lynas Corp. Ltd. of Australia planned to develop the rare-earth deposit at Mount Weld in Western Australia and to ship rare-earth concentrates to Malaysia for further processing. Lynas secured approval from the Malaysian Government to build an advanced material plant in the Gebeng III industrial area, which is located near the Port of Kuantan in the State of Pahang. The construction of the plant was underway and was scheduled to be completed in late 2009. Initial design of the plant was to have an output capacity of 10,500 t/yr of rare-earth-oxide-equivalent products. Given the global shortfall in the supply of rare earths, Lynas planned to increase the output capacity to 21,000 t/yr in a second-phase design (Lynas Corp. Ltd., 2009, p. 15).

Tin.—Owing to depleted resources and lower ore grades after more than 100 years of active mining operations, Malaysia's tin mine production decreased to less than 3,000 t/yr. Solder production was the leading tin consuming sector in Malaysia, followed by tinplate, and pewter. Recently, tin consumption in Malaysia decreased to about 3,500 t in 2007 from more than 5,500 t in the 1990s. The decrease in tin consumption was mainly from the solder sector; consumption by other consumers remained at the same level during that period. Owing to an increase in tin mine operating costs, Malaysian tin miners had difficulty operating profitably despite the higher demand for and price of tin. Malaysia Smelting Corp. Bhd. (MSC) was Malaysia's sole integrated tin producer; it produced 31,630 t of refined tin at its Butterworth smelter in 2008, which was about 24% more than it produced in 2007. The increase in tin production was a result of MSC's ability to source raw material from overseas markets. In 2008, Malaysia imported 20,987 t of tin concentrates compared with 20,643 t in 2007, mainly from Australia, Indonesia, and South Africa. Domestic mined tin production also increased by more than 20% in 2008 compared with that of 2007. The Republic of Korea, Singapore, Japan, and Taiwan (in descending order by volume) were the main destinations for Malaysian tin exports (Malaysia Smelting Corp. Bhd., 2009, p. 118-119; Malaysian Tin Bulletin, 2009).

Industrial Minerals

Cement.—In Malaysia, the cement industry operates under price controls, which means that prices can remain unchanged for a long period of time. To offset increases in the costs of transport, packaging, and utilities, the cement producers urged the Government to increase cement prices to match those in the region. Also, builders and developers asserted that shortages of cement were caused by the price controls. There had been no adjustment in local cement prices since 1995. In December 2006, the Government increased the cement price by 9%; however, the production costs increased by more than 40% during the same period. In 2007, the Government introduced an automatic pricing mechanism (APM), and cement was placed under this category; as a result, the price of cement was to be reviewed every 4 months. Under the APM, cement prices could be automatically adjusted to costs, and the Government ensured that there would be a reasonable profit margin to encourage investment by the cement producers. On June 5, 2008, the Government removed the ceiling prices on cement to ensure that development projects would not be delayed because of the tight supply of cement in the domestic market. The control of cement prices had discouraged producers from increasing their output volume even though the country's cement output capacity exceeded domestic demand. As a result, the development of many infrastructure projects was delayed. The Government also set the import duty for cement at 10% instead of the previous rate of between 25% and 50%, and importers in the States of Sabah and Sarawak were exempt from the requirement to obtain import licenses. On November 4, the Government abolished the 10% import duty for cement under its stimulus package. The changes were to ensure that the cement market would be more transparent and efficient (Star, The, 2008a; Bank Negara Malaysia, 2009, p. 28).

Mineral Fuels

Coal.—Malaysia's coal resources are located in the States of Perak, Perlis, Sabah, Sarawak, and Selangor. Coal was produced from the areas of Bintulu, Merit-Pila, Silantek, and Tutoh in the State of Sarawak. The country has coal resources of 1.7 billion metric tons (Gt), of which 274 Mt was measured, 347 Mt was indicated, and 1.1 Gt was inferred. About 1.4 Gt of the country's resource is located in Sarawak. Mining and exploration for coal were conducted only in Sarawak. Power-generating plants consumed about 70% of the total supply of coal (domestic production and imports), and the remaining supply was consumed by the cement and iron and steel sectors. Despite Malaysia's position as a natural gas exporter, Tenaga Nasional Berhad planned to decrease the use of natural gas at its powerplants to 49% from 72% and to shift to the use of coal because of a shortage in the supply of natural gas in the domestic market. In 2008, the State government of Sabah decided to cease the construction of a 300-megawatt coal-fired powerplant in Lahad Datu on Borneo Island to meet an increased electricity demand in the State of Sabah because the proposed plant would be located near the protected rainforest area. Coal consumption was expected to increase to 19.5 Mt in 2010 and, because domestic coal could not meet the demand, the country was expected to increase coal imports to fill the gap. Most imported coal was from Australia, China, and Indonesia (Minerals and Geoscience Department, 2009).

Natural Gas and Petroleum.—Malaysia remained a net exporter of natural gas and crude oil. Production of natural gas decreased by about 4% to 158 million cubic meters per day in 2008. The decrease of natural gas production was caused by the slow growth of external demand for LNG and an unplanned maintenance shutdown at several gasfields in Peninsular Malaysia. Production of crude oil and condensate increased by about 2% to an average of 694,000 barrels per day in 2008. The increased production of crude oil was driven by the increased output from the Kikeh oilfield in the State of Sabah; this oilfield was put into operation in 2007. The State of Sabah accounted for 21.7% the country's total production (Bank Negara Malaysia, 2009, p. 27).

The Governments of Brunei and Malaysia signed an agreement to resolve a maritime border dispute that had stopped oil exploration off Borneo Island. According to the agreement, both countries would collaborate in the exploration and exploitation of contested oil blocks. Both countries awarded exploration rights for a total of four blocks to international exploration companies where some blocks overlapped. The four blocks were estimated to contain a total of 440 million barrels of oil reserves (Star, The, 2009).

Outlook

With the global economic slowdown, Malaysia's economy is projected to grow at a slower rate during the next 3 years than in the previous several years. The expected decline of commodity prices will likely affect export earnings and fiscal revenue. Private and public spending, however, will likely continue to support economic growth. The construction sector is expected to expand as a result of increased investment by the Government in infrastructure under the Ninth Malaysia Plan, and the demand for construction steel products will also likely increase. Several natural gas and oil projects are set to come onstream during the next several years, and the production of natural gas and oil is expected to increase.

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TABLE 1
MALAYSIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008[e]
METALS						
Aluminum, bauxite, gross weight		2,040	4,735	91,806	156,785	150,000
Gold, mine output, Au content[3]	kilograms	4,221	4,250	3,497	2,913	2,400
Iron and steel:						
Iron ore, gross weight		663,732	949,605	667,082	802,030	800,000
Pig iron, direct-reduced iron and hot-briquetted iron	thousand metric tons	1,710	1,349	1,277	1,872	1,957 [4]
Steel, crude	do.	5,698	5,296	5,834	6,895	6,423 [4]
Lead metal, secondary[e]		54,000 [r]	71,000 [r]	73,000 [r]	73,000 [r]	73,000
Niobium (columbium)-tantalum metals, struverite, gross weight		121	552	93	52	50
Rare-earth metals, monazite, gross weight		1,683	320	894	682	650
Silver, mine output, Ag content[3]	kilograms	364	401	410	295	290
Tin:						
Mine output, Sn content		2,745	2,857	2,398	2,263	2,578 [4]
Metal, smelter		33,914	36,924	22,850	25,471 [r]	31,630 [4]
Zirconium, zircon concentrate, gross weight		6,886	4,954	1,690	7,393	7,000
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	15,692	17,860	18,400	19,480	19,000
Clays and earth materials	do.	24,221	28,757	25,081	28,102	25,000
Feldspar		79,220	117,180	142,358	358,775	300,000
Kaolin		326,928	494,511	341,223	587,508	400,000
Mica		3,544	4,542	5,152	6,118	6,000
Nitrogen, N content of ammonia		842,500	920,000	950,000	950,000	950,000
Sand and gravel	thousand metric tons	18,371	17,072	25,225	22,370	22,000
Silica sand, peninsular Malaysia and Sarawak		631,402	531,891	512,277	719,221	700,000
Stone:						
Aggregate	thousand metric tons	51,236	62,761	79,912	79,118	75,000
Dolomite		27,500	38,500	37,702	49,320	49,000
Limestone	thousand metric tons	31,598	30,868	33,471	58,118	58,000
Titanium:						
Ilmenite concentrate, gross weight		61,471	38,196	45,649	59,310	59,000
Dioxide[e]		56,000	56,000	56,000	56,000	56,000
MINERAL FUELS AND RELATED MATERIALS						
Coal		389,176	789,356	901,801	1,074,936	1,050,000
Gas, natural:						
Gross	million cubic meters	63,165	70,471	70,191	71,170	68,000
Net[5]	do.	53,691	59,901	59,663	60,490	57,648 [4]
Liquefied natural gas	thousand metric tons	20,729	21,948	21,948	22,669	20,000
Petroleum:						
Crude and condensate	thousand 42-gallon barrels	279,009	267,720	243,455	249,295 [r]	253,310 [4]
Refinery products[e, 6]	do.	225,000	218,000	208,000	220,000	210,000

[e] Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r] Revised. do. Ditto.

[1] Table includes data available through October 30, 2009.

[2] In addition to the commodities listed, a variety of crude construction materials, which include clays and stone, fertilizers, and salt, is produced but not reported, and information is inadequate to make reliable estimates of output.

[3] Includes byproduct from tin mines in peninsular Malaysia and gold mines in peninsular Malaysia and the State of Sarawak.

[4] Reported figure.

[5] Includes production from peninsular Malaysia and the States of Sabah and Sarawak.

[6] Gross less volume of reinjected and flared.

Sources: Ministry of Primary Industry, Minerals and Geoscience Department (Kuala Lumpur), Malaysian Minerals Yearbook 2007; U.S. Geological Survey Minerals Questionnaire, 2007; and Southeast Asia Iron and Steel Institute, Steel Statistical Yearbook, 2009.

TABLE 2
MALAYSIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bauxite		Johore Mining and Stevedoring Co. Sdn. Bhd. (Alcan Ltd. of Canada, 61%, and local investors and others, 39%)	Teluk Rumania and Sg. Rengit, Johor	400.
Cement[1]		Cement Industries of Malaysia Bhd. (United Engineers Malaysia Bhd., 53.97%, and others, 46.03%)	Kangar, Perlis and Bahau, Negeri Sembilan	3,400 cement; 2,800 clinker.
Do.		CMS Cement Sdn Bhd (subsidiary of Cahya Mata Sarawak Bhd)	Bintulu and Kuching, Sarawak	1,750 cement; 600 clinker.
Do.		Holcim (Malaysia) Sdn Bhd (Holcim Ltd.)	Pasir Gudang, Johor	1,200 cement.
Do.		Lafarge Malayan Cement Bhd. (subsidiary of Lafarge S.A.)	Rawang, Selangor; Kanthan, Perak, Langkawi, Kedah; and Pasir Gudang, Johor	12,950 cement; 8,200 clinker.
Do.		YTL Cement Berhad (subsidiary of YTL Group)	Bukit Sagu, Pahang; Padang Rengas, Perak; and Pasir Gudang and Wesport, Johor	5,700 cement; 4,200 clinker.
Do.		Perak-Hanjoong Simen Sdn. Bhd. (Gopeng Bhd., 45%, and Korea Heavy Industries and Construction Co. and others, 55%)	Padang Rengas, Perak	3,400 cement; 3,000 clinker.
Do.		Tasek Corp. Bhd (publicly owned company)	Ipoh, Perak	2,300 cement; 2,300 clinker.
Gas:				
Natural	million cubic meters per day	ExxonMobil Exploration and Production Malaysia, Inc.	Offshore Terengganu	45.
Do.	do.	Sabah Shell Petroleum Co. Ltd.	Offshore Sabah	3.
Do.	do.	Sarawak Shell Bhd.	Offshore Sarawak	80.
Liquefied		Malaysia LNG Sdn. Bhd. (Petroliam Nasional Berhad, 65%; Shell Gas N.V., 15%; Mitsubishi Corp., 15%; Sarawak State government, 5%)	Tanjung Kidurong, Bintulu, Sarawak	8,100.
Do.		Malaysia LNG Dua Sdn. Bhd. (Petroliam Nasional Berhad, 60%; Shell Gas N.V., 15%; Mitsubishi Corp., 15%; Sarawak State government, 10%)	do.	7,800.
Do.		Malaysia LNG Tiga Sdn. Bhd. (Petroliam Nasional Berhad, 60%; Shell Gas N.V., 15%; Nippon Oil LNG (Netherlands) BV, 10%; Sarawak State government, 10%; Diamond Gas Netherlands BV, 5%)	do.	6,800.
Gold, refined	kilograms	Specific Resources Malaysia Sdn. Bhd. (joint venture of Pahang State Development Corp. and Avocet Mining Plc)	Penjom, Pahang	4,000.
Iron and steel:				
Direct-reduced iron		Lion DRI Sdn Bhd (Lion Group)	Banting, Selangor	1,540.
Do.		Perwaja Steel Sdn. Bhd. (Kinsteel Bhd, 51%, and Maju Holdings Sdn. Bhd., 49%)	Kemaman, Terengganu	1,800.
Hot-briquetted iron		Amsteel Mills Sdn Bhd (Lion Group)	Labuan Island, offshore Sabah	880.
Crude steel		do.	Banting, Selangor	1,250.
Do.		do.	Klang, Selangor	750.
Do.		Ann Joo Steel Bhd (Ann Joo Group)	Prai, Penang	900.
Do.		Antara Steel Sdn. Bhd. (Lion Grop)	Pasir Gudang, Johr	600.
Do.		Kinsteel Sdn Bhd	Kuantan, Pahang	500.
Do.		Megasteel Sdn Bhd (Lion Group)	Banting, Selangor	700.
Do.		Malaysia Steel Works Bhd	Bukit Raja, Selangor	450.
Do.		Perwaja Steel Sdn. Bhd. (Kinsteel Bhd, 51%, and Maju Holdings Sdn. Bhd., 49%)	Kermaman, Terengganu	1,500.
Do.		Southern Steel Bhd. [Camerlin (a member of Hong Leong Group Malaysia), 40.75%; Natsteel Ltd., 27.03; others, 32.22%]	Prai, Penang	1,300.
Nitrogen, ammonia		Asean Bintulu Fertilizer Sdn. Bhd. (Petroliam Nasional Berhad, 63.5%; P.T. Pupuk Sriwidjaja Indonesia, 13%; Thai Ministry of Finance, 13%; Philippines National Development Co., 9.5%; Singapore Temasek Holdings Pte. Ltd., 1%)	Bintulu, Sarawak	395.
Do.		Petronas Fertilizer Kedah Sdn. Bhd. (wholly owned subsidiary of Petroliam Nasional Berhad)	Gurun, Kedah	378.
Do.		Petronas Ammonia Sdn. Bhd. (wholly owned subsidiary of Petroliam Nasional Berhad)	Kerth, Terengganu	370.

See footnotes at end of table.

TABLE 2—Continued
MALAYSIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum, crude	thousand 42-gallon barrels per day	ExxonMobil Exploration and Production Malaysia, Inc.	Offshore Terengganu	390.
Do.	do.	Sabah Shell Petroleum Co. Ltd.	Offshore Sabah	100.
Do.	do.	Sarawak Shell Bhd.	Offshore Sarawak	184.
Do.	do.	do.	do.	184.
Do.	do.	Petronas Carigali Sdn. Bhd.	Offshore Terengganu	22.
Do.	do.	Murphy Sarawak Oil Co. Ltd.	Offshore Sarawak	15.
Tin:				
Concentrate		Delima Industries Sdn. Bhd.	Dengkil, Selangor	1.1.
Do.		Maiju Sama Sdn. Bhd.	Puchong, Selangor	1.6.
Do.		New Lahat Mines Sdn. Bhd.	Lahat, Perak	0.3.
Do.		Omsam Telecommunication Sdn. Bhd.	Bakap and Batu Gajah, Perak	0.5.
Do.		Rahman Hydraulic Tin Bhd.	Klian Intan, Perak	1.2.
Do.		S.E.K. (M) Sdn. Bhd.	Kampar, Perak	0.4.
Do.		Tasek Abadi Sdn Bhd.	Senudong and Kampar, Perak	0.5.
Refined		Malaysia Smelting Corp. Bhd. (The Straits Trading Co. Ltd., 37.44%; Malaysia Mining Corp., 37.44%; others, 25.12%)	Butterworth, Penang	35.
Titanium dioxide		Huntsman Trioxide Sdn. Bhd. (a subsidiary of Huntsman Tioxide)	Kemaman, Terengganu	56.

Do., do. Ditto.

[1] All companies operated integrated plants.

THE MINERAL INDUSTRY OF MONGOLIA

By Susan Wacaster

After decades of having a state-controlled economy, Mongolia transitioned to a market-based economy in 1990 and adopted a new Constitution in 1992 that emphasized private ownership practices. In the early 1990s, animal husbandry was the leading sector of the economy; in recent years, however, the real gross domestic product (GDP) had been augmented by the mining sector. Before 1990, some mineral resources were directed for export to eastern European countries, whereas production of coal, petroleum, and some salts was primarily for domestic use. Since then, the country had become increasingly reliant upon mineral resources for its economic development, and began exporting mineral commodities to Canada, China, the European Union, Russia, and the United States. In 2007, mineral sector revenues accounted for 39% of the national budget. In 2008, Mongolia was the world's third ranked producer of fluorspar after China and Mexico, producing both acid and metallurgical grades (Miller, 2009; World Bank, The, 2009a, b).

The Geological Survey of Mongolia was established in 1939 and began collaborating with the Soviet Union and east European countries at that time. From 1939 to 1990, significant deposits of copper, fluorite, gold, iron, lead, molybdenum, phosphate, quartz, tin, tungsten, uranium, and zinc were discovered and mined. From 1940 to 1970, quartz, placer tin, and tungsten-tin vein deposits were mined out with assistance from the Soviet Union. Rare-earth metal deposits were discovered in various areas of eastern Mongolia. By 2001, about 94% of the country had been geologically mapped at the 1:200,000 scale and 1:50,000-scale maps were completed for 16% of the territory. At that time, 70% of the country had been covered by airborne geophysical surveys. In 2008, about 25% of the country was covered by general exploration work and geologic mapping at the 1:50,000 scale. Mongolia was found to have more than 6,000 mineral deposits, and the Mongolian Government had classified 34 of those as strategically significant, including coal, copper, gold, phosphorus, and silver deposits (Dugerjav and others, 2001; Mineral Resources Authority of Mongolia, 2009).

Minerals in the National Economy

The mining industry's contribution to the total GDP increased to 28.2% in 2008 from 12.6% in 2002. Mongolia's economy was heavily affected by the global economic crisis of 2008 as the prices of Mongolia's main exports, including coal, copper, and zinc, fell to 2004 levels. Mongolia's preliminary estimate of GDP growth for 2008 was reported to be 8.9% compared with 9.9% in 2007. Foreign direct investment was received primarily by the mining sector; however, the value added for the year was only 1.7% (Mineral Resources Authority of Mongolia, 2009; World Bank, The, 2009b).

Government Policies and Programs

The Government's reliance upon mining as a source of revenue had increased since 2005 with the introduction of a windfall profits tax (imposed, for example, on sales of copper ore and concentrate and levied at a rate of 68% on the difference between actual copper prices and the sum of a base price for ore plus the cost of smelting) and reductions in the value-added tax (an incremental tax levied on the value added at each stage of processing; effectively, a sales tax on the ultimate consumer). The windfall tax has become an important input to the national budget, contributing 7.8% of total public revenues in 2007, and has been a main source of revenue for Mongolia's Government Development Fund. The Mongolian Minerals Act of 2006 entitles the Government to an ownership interest of up to 34% in mining properties generally, and up to 50% in properties defined as strategic (World Bank, The, 2009b).

Amendments to the Minerals Act of 2006 were proposed that could change the Government's ownership percentages, but they were not passed in 2008. In June, parliamentary elections were held in which the main parties disputed whether the Government, or private companies, should hold the majority interest in the country's mineral deposits. The winning party, which reportedly campaigned for Government interests, gained 46 of the 76 seats in the Parliament whereas the opposing party won about 20 seats. The elections were contested, and violence broke out in the country, which resulted in a state of emergency. The outgoing Parliament had been trying to amend the Minerals Law to prevent the Government from finalizing development agreements with major international mining companies. Under the law as it stood, the Government held up to a 50% interest in mineral deposits if state funds were used to discover them and up to 34% if state funds were not used. A proposed amendment would give the Government at least 34% ownership in general and at least 51% for strategic properties (Bank Information Center, 2008; Western Prospector Group Ltd., 2009, p. 8).

Production

In 2008, production of cement, coal, iron ore, lime, crude petroleum, and silver increased compared with production in 2007 whereas the production of other important mineral commodities, including copper, fluorspar, gold, molybdenum, and zinc, decreased from 2007 to 2008. The decrease in gold production was reportedly related to a $750 per troy ounce threshold level for the windfall tax, which was raised to $850 in hopes of increasing the volume of gold sold to the Central Bank of Mongolia. Small producers had been stockpiling or otherwise moving the gold to avoid paying the tax, thereby adding to the Government's revenue shortfall. Production of iron ore increased by more than 400% to 1,387 metric tons (t) in 2008 from 265 t in 2007; however, iron ore was currently being mined by Chinese companies and no reports were readily available that could explain the increase. Crude petroleum production increased to 1,174,000 barrels (bbl) in 2008 from 913,000 bbl in 2007, likely owing to the increased drilling and exploration being done as petroleum blocks were developed throughout the country. In 2008, a total of 448 wells were drilled, including 307 in the Toson Uul XIX Block, 75 in the PSC-97 Block, 57 in the Tamsag XXI Block, 5 in the Buir XXII Block, 3 in the Tariach XV Block, and 1 in the Matad-XX Block (Khan Resources Inc., 2009, p. 3; Petroleum Authority of Mongolia, 2009).

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities. In 2008, there were 213 actively operating mining companies in Mongolia that employed about 45,900 people. In 2008, 5,202 licenses, including 4,111 exploration and 1,091 mining licenses, covered an area of about 49.4 million hectares (ha). The number of deposits that were registered by the Mineral Council of Mongolia increased to 88 in 2008 from 29 in 2005. Domestic companies held a greater number of mining licenses than foreign companies and joint ventures (about 67% of the total); however, the licenses held by foreign and joint-venture companies covered larger areas (Mineral Resources Authority of Mongolia, 2009).

In September 2008, Ivanhoe Mines Ltd. of Canada received $47 million from Rio Tinto to purchase equipment for the Oyu Tolgoi copper and gold mine project, which was located in the Omnogavi Province of Mongolia. The Oyu Tolgoi project was Ivanhoe Mines' principal mineral resource property. (The Ovoot Tolgoi Coal Mine is the group's other important project in the country.) Ivanhoe Mines received another $74.5 million from Rio Tinto in November as part of the purchase and sale agreement, for a total of $121.5 million. Ivanhoe Mines was to use the funds for future development of the Oyu Tolgoi project. As of early 2009, the two companies were continuing to work with the Mongolian Government to facilitate approval of the draft investment agreement for the Oyu Tolgoi project (Ivanhoe Mines Ltd., 2009, p. 11-13).

The conditions of a joint-venture agreement between Ivanhoe Mines and Entrée Gold Inc. of Canada were satisfied after Ivanhoe Mines spent greater than $35 million on two properties covered by the agreement (the Javkhlant and the Shivee Tolgoi licenses). Ivanhoe Mines gained an 80% interest in minerals below 560 meters (m) and a 70% interest in minerals above that level in the deposits. The exploration licenses that were renewed in June were due to expire in 2010 and would expire if they were not converted to mining licenses by that time. In March 2008, Ivanhoe Mines announced the estimated inferred resources at the Heruga deposit—a recently discovered deposit of the Oyu Tolgoi project on lands covered by the joint-venture agreement with Entrée—to be 760 million metric tons (Mt) grading 0.48% copper, 0.55 gram per metric ton (g/t) gold, and 142 g/t molybdenum, using a 0.60% copper equivalent cutoff grade (Entrée Gold Inc, 2009; Ivanhoe Mines Ltd., 2009, p. 13).

Western Prospector Group Ltd. of Canada had mineral properties in Mongolia, including the Saddle Hills uranium project and the Baganuur and the Choybalsan coal projects. The company had been exploring for mineral deposits in Mongolia since 2004. As of December 31, 2007, the company held 19 exploration licenses on about 178,000 ha throughout Mongolia; however, some of those licenses had been under litigation. The properties included six coal exploration projects and the Gurvanbulag Central uranium project, which was composed of 13 mineral exploration licenses in northeastern Mongolia. In May 2008, Khan Resources, Inc. filed an offer to acquire all the outstanding common shares of Western Prospector to consolidate its position in the Saddle Hills district and benefit from the development of Khan Resources' Dornod uranium deposit and Western Prospector's Gurvanbulag uranium deposit in the same district. Western Prospector declined that, and subsequent, offers. In July 2008, it was announced the Tinpo Holdings Industrial Co. Ltd. had an agreement to acquire all the outstanding common shares of Western Prospector in a takeover bid. By October, Khan Resources' offers had expired and Tinpo had withdrawn its offer (Khan Resources Inc., 2009, p. 1, 8-11; Western Prospector Group Ltd., 2009, p. 1-8).

Mineral Trade

In 2008, about 75% of Mongolia's total export revenue was derived from mineral commodities. Of that percentage, copper accounted for 33%; gold, 24%; coal, 7%; zinc, 6%, and petroleum, 4%. Mongolia received 66% of its total export revenue from China, followed by Europe, 17%; the United States and Canada, 11%; Russia, 3%; and the remainder, from other countries (Mineral Resources Authority of Mongolia, 2009; World Bank, The, 2009b).

Mongolia was the United States' 161st ranked trade partner, with $110 million in two-way goods traded in 2008, and was a member of the United States Generalized System of Preferences (GSP) program. The GSP program was created by the U.S. Congress in 1974 to expand the United States' trade options while creating economic opportunities in developing countries. The program has provided for duty-free trade for about 130 countries and territories. Out of $51.5 million in total Mongolian exports to the United States, $5.6 million entered the United States duty free compared with $906,500 of GSP duty-free exports out of $84 million in total Mongolian exports received in 2007 (Office of the U.S. Trade Representative, 2009a).

In 2008, Mongolia was the United States' 139th ranked supplier of goods. Inorganic chemicals valued at $6 million was the third ranked good and unspecified fluorspar and salt, together valued at $2 million, were the 5th ranked goods received by the United States from Mongolia. Mongolia was the United States' 163rd ranked goods export market in 2008, but no mineral products were among the top ranked products received by the country (Office of the U.S. Trade Representative, 2009b; World Bank, The, 2009b)

Commodity Review

Metals

Copper, Gold, and Molybdenum.—In December 2008, Ivanhoe Mines made a discovery of high-grade copper and gold mineralization at the Oyu Tolgoi project, which is located in the South Gobi desert about 550 kilometers (km) south of

Ulaanbaatar and 80 km north of the Mongolian-China border. Porphyry copper, gold, and molybdenum have been found along a 20-km zone of deposits. Zones of high-grade copper and gold mineralization were intersected across a distance of 370 m grading 0.83 g/t gold, 0.53% copper, and 64 g/t molybdenum. These zones included an intersection of 78.3 m grading 2.13 g/t gold, 0.82% copper, and 126 g/t molybdenum and a sub-interval of 16.3 m grading 4.70 g/t gold, 1.56% copper, and 168 g/t molybdenum. The Oyu Tolgoi mineral district formed from an island arc terrain, and lies in an east-west-trending belt that runs through southern Mongolia; it is about 200-km wide and 750-km long. In 2003, geophysical surveys and deep drilling led to the discovery of the largest deposit in the district, the Hugo Dummet North, where advanced argillic alteration in basaltic rocks developed over a vertical interval of 500 m above quartz monzodiorite intrusions that accompanied porphyry-style copper-gold mineralization. Ivanhoe Mines had been seeking an investment agreement with the Government to develop the Oyu Tolgoi project for several years. An initial draft investment agreement was negotiated between Ivanhoe Mines and Rio Tinto with the Government of Mongolia; however, the draft agreement was withdrawn by the Prime Minister later in the year (prior to the 2008 elections) for review and evaluation by independent experts (Hayashi and others, 2008; Ivanhoe Mines Ltd., 2009, p. 9-13).

In 2008, Ivanhoe Mines completed 36,092 m of drilling at the Oyu Tolgoi project. The company planned to continue drilling to determine whether there was a continuous, high-grade mineralized connection between major deposits in the north and the Heruga deposit to the south. The new discovery was located between the Heruga deposit, which is located on the joint Ivanhoe Mines-Entrée license area in 2007, and the Southern Oyu deposits that were delineated by exploration between 2001 and 2005 (Ivanhoe Mines Ltd., 2009, p. 11-13).

In June 2008, Centerra Gold Inc. began processing low-grade ores at a newly commissioned heap-leach facility at its wholly owned Boroo Mine. The Boroo Mine is located 110 km northwest of Ulaanbaatar near the Trans-Mongolian railway. The Boroo Mine is an open pit operation that began commercial production in 2004 and produced more than 37,000 kilograms (kg) (1.2 million troy ounces) of gold through the end of 2008. In 2008, the Boroo Mine produced about 6,000 kg (193,000 troy ounces) of gold, including heap-leach production of about 780 kg (25,000 troy ounces). The company received a temporary 6-month permit to start production at the facility in April as final permits and a feasibility study were pending (Centerra Gold Inc., 2009, p. 15-17).

Erdene Resource Development Corp.'s Zuun Mod Molybdenum project was a porphyry molybdenum deposit with copper and rhenium located in Bayankhongor Province about 950 km southwest of Ulaanbaatar. The property consisted of a single license, registered with the wholly owned subsidiary Anian Resources XXK, that totaled about 50,000 ha. The property had been under exploration since 2005 and was acquired from Gallan Minerals Ltd. in 2005. The Zuun Mod was one of the largest molybdenum projects in northern Asia. In 2007, a drilling program identified three mineralized zones within a 3.5-km-long area of the South Corridor. A May 2008 resource estimate included total measured and indicated resources of about 65.8 million kilograms (Mkg) (145 million pounds) of molybdenum and 82.6 Mkg (182 million pounds) of copper that averaged from 0.06% to 0.08% Cu. The company reported at least two areas where higher grade mineralization (0.07% to 0.09% Mo) was found within 50 m from the surface. A prefeasibility program was planned for 2009 (Erdene Resource Development Corp., 2009, p. 2, 13-14).

Mineral Fuels and Related Materials

Coal.—Mongolia had 26 main coal deposits throughout the country composed mostly of lignite and subbituminous-grade coal, but also bituminous-grade coal. In 2008, 95% of the country's electricity was generated from coal-fired powerplants and greater than 80% of the coal consumed in the country was used to generate electricity. Coal was in demand year-round. Prices decreased in the summer, however, which allowed some consumers with capital to buy relatively large amounts of coal (that is, in truckloads of about 5 t) at relatively reduced prices, whereas those consumers who did not have the liquidity to buy in bulk spent more for individual sacks of coal (about 25 kg) throughout the year (Bayarsaikhan, 2009; World Bank, The, 2009b).

The country implemented a plan of action for the coal industry with objectives outlined for the years 2008 through 2012. Those objectives included creating a smokeless household fuel supply (using processes that remove volatile elements from coal), implementation of coal liquefaction and gasification projects (using processes that derive liquid fuels, such as gasoline and diesel, from coal), provision of a stable coal supply to powerplants (by renovating the Baganuur and the Shivee Ovoo coal mines, which began operations in 1978 and 1992, respectively), and development of coalbed methane gas as an energy source through implementation of projects with the Mongolian Geological Survey and creation of a legal environment for use of the fuels (Bayarsaikhan, 2009).

Official estimates showed that the value of the investment needed for a smokeless fuel manufacturing project was $7.5 million and would produce 120,000 metric tons per year (t/yr) of coal briquets and 100,000 t/yr of a semicoke product. One feasibility study to build a coal liquefaction plant in Mongolia estimated that the total capital required would be about $2.4 billion. Such a plant would process greater than 6,000 metric tons per day of coal and produce about 11,300 barrels per day (bbl/d) of diesel, 7,000 bbl/d of fuel oil, 6,300 bbl/d of gasoline, and 900 bbl/d of liquefied petroleum gas (LPG). Another study determined that a coal liquefaction project, based on the Tugrugnuur lignite deposit project located 170 km southeast of Ulaanbaatar, would require between $3 billion and $4 billion, would produce 18,000 bbl/d of gasoline and some quantity of LPG, and was reportedly under way with an estimated completion date of 2013 (Bayarsaikhan, 2009; Industrial Corporation Mongolia, 2009).

SouthGobi Energy Resources, Ltd. of Canada was expanding coal sales to China from the company's Ovoot Tolgoi Mine in southern Mongolia. In April, SouthGobi received Government approval to mine coal at the Ovoot Tolgoi coal mine and subsequently began mining and stockpiling coal from the West field. The Ovoot Tolgoi open pit coal mine was located 45 km north of the border with China. SouthGobi controlled 43 licenses on more than 16,000 square kilometers in Mongolia. Ivanhoe Mines had an 80% share in SouthGobi (SouthGobi Energy Resources Ltd., 2009).

Petroleum.—Mongolia's sedimentary basins were divided into 25 exploration blocks for international bidding, and the Petroleum Authority of Mongolia was working to add four more. Exploration blocks were located mostly in the southern half of the country in central, eastern, and western Mongolia. The East Gobi sedimentary basin encompassed four petroleum subbasins in east-central Mongolia. The Zuun Bayan basin was discovered in 1941 when there was intensive exploration and extraction. The Tamsag basin was discovered in eastern Mongolia in the 1990s and a 2001 Chinese National Oil Corp. survey of the basin estimated its reserves to be 1.5 billion bbl. In recent years, other fields have been explored and exploited, including the Tasagaan Els basin and some basins in western Mongolia. Exploration activities from 1994 to 2008 included 17,600 km of two-dimensional seismic work, 6,000 km of three-dimensional seismic work, the drilling of 448 wells, and foreign direct investment of $952 million (Prost, 2004; Amarsaihan, 2009; Petroleum Authority of Mongolia, 2009).

In 2008, petroleum exploration and production activities were being conducted by one Canadian company (Shaman Resources, LLC); three Chinese companies (PetroChina Daching Tamsag-Mongolia LLC, Dong Sheng Petroleum LLC, and China Golden Sea, LLC); and one Mongolian company (Petro Matad LLC). The Toson-Uul and PSC-97 Blocks were production blocks with 50 and 31 producing wells, respectively. The Toson-Uul Block produced 3,800 bbl/d and the PSC-97 Block produced 1,800 bbl/d, and together, the blocks have produced, cumulatively, about 3.4 Mbbl (of which 3.1 Mbbl was exported because the country does not have a refinery to process the petroleum). The country reported that, by 2010, PetroChina Daching Tamsag-Mongolia would produce about 3 million barrels per year (Mbbl/yr) and that, by 2015, that number would reach 11.3 Mbbl/yr (Amarsaihan, 2009; Petroleum Authority of Mongolia, 2009).

In 2008, Mongolia imported 92% of its petroleum products from Russia, about 6% from China, less than 2% from Korea, and less than 1% from Kazakhstan. The country had future plans to construct a crude oil refinery and expand exploration in the Dornogob and the Tamsag basins. Mongolian gasoline prices increased by 40% during the summer months of 2008 owing to the combined effects of steeply increasing world crude oil prices and an announcement from Russia that Russia's export tax would be increased by 20% starting in August. Consequently, Russia announced a plan to cut taxes on crude oil to stimulate domestic oil production after the country's oil production decreased because of rising production costs and maturing fields (World Bank, The, 2009b).

Uranium.—Most identified uranium deposits were located in the eastern part of the country; however, exploration had not been completed in western Mongolia. Important sites were located in Dornod, Gurvanbulag, and Mardai. In 2008, Mongolia's objective was to develop a nuclear fuel cycle. To do so, the country planned to increase uranium reserves, create nuclear front-end production capabilities, and become a regional fuel cycle center. In February 2009, a state-owned uranium company, Mon-Atom, LLC, was established to deal with uranium exploration and development. The company would also be involved with alternative energy sources, including bioenergy, solar, and wind.

Khan Resources received a 3-year renewal of its exploration license of the Dornod uranium project, which is located about 650 km east of Ulaanbaatar. The company started a definitive feasibility study, submitted reserve calculations as required by the Government for conversion from an exploration to a mining license (resource estimates submitted to the Government varied slightly because of reporting requirements, but were similar to the NI43–101-compliant estimate), and constructed a power-line tower and a sedimentation pond. The Dornod property was composed of an open pit mine and an underground deposit. The open pit mine produced 590,000 t of material between 1988 and 1995. The underground deposit remained partially developed with two shafts and about 20,000 m of drifts. The property had an indicated reserve of about 29.2 Mkg (64.3 million pounds) of U_3O_8, and Khan Resources had an overall interest in about 20.2 Mkg (44.4 million pounds) of U_3O_8 (Gombo, 2009; Khan Resources Inc., 2009).

Outlook

At the end of 2008, the legislative and business choices required to create a successful and sustainable mining industry were still being debated in Mongolia. By yearend, the country had not signed an investment agreement with Ivanhoe Mines (with Rio Tinto) on the Oyu Tolgoi project. The Government was at a point at which it could either make agreements with international mining groups who have the technical ability and capital to develop deposits or continue to stall on agreements until interested parties pull out of the country, leaving undeveloped mineral resources to be optioned. Until agreements on the country's largest and most valuable mineral properties are resolved and enough time passes for those projects to become producers, the economic downturn of 2008 may linger. Mongolia, however, is experiencing rapid change. Its infrastructure is still being developed and its territory is still being explored. By the time the Minerals Act is revised and current development projects are under way, the mineral wealth will still be available, but it remains to be seen how that wealth will be distributed and directed.

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TABLE 1
MONGOLIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
Cement, hydraulic	thousand metric tons	62	112	141	180	270
Coal, unspecified	do.	6,794	8,256	7,885	9,560	9,692
Copper:						
Mine output, Cu content		130,000	126,547	129,693	130,160	126,796
Metal, refined		2,376	2,475	2,618	3,007	2,587
Fluorspar:						
Acid grade	thousand metric tons	148	134	138	131	116
Submetallurgical and other grade	do.	206	233	255	250	219
Total	do.	354	367	393	381	335
Gold, mine output, Au content[3]	kilograms	19,240	24,120	22,561	17,473	15,184
Gypsum[e]	thousand metric tons	25	25	26	26	26
Iron ore:						
Gross weight	do.	33	168	180	265	1,387
Iron content	do.	21	109	116	170	888
Lime, hydrated and quicklime	do.	30	81	60	43	55
Molybdenum, mine output, Mo content		1,141	1,188	1,404	1,978	1,900 [e]
Petroleum, crude	thousand 42-gallon barrels	216	201	369	913	1,174
Salt, mine output		1,550	1,896	1,154	1,143	103
Silver, mine output, Ag content[e, 4]	kilograms	28,000	28,000	28,000	28,100	28,890 [5]
Steel, crude		54,900	65,500	70,000	80,400	81,400
Stone, crushed	thousand metric tons	--	--	269	208	207 [6]
Tungsten, mine output, W content		77	54	85	245 [r]	142
Zinc, mine output, Zn content		--	11,400	54,850	77,350	71,800

[e] Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r] Revised. do. Ditto. -- Zero.

[1] Table includes data available through August 10, 2009.

[2] In addition to the commodities listed, crude construction materials, such as sand and gravel, and varieties of stones, such as limestone and silica are produced, but available information is inadequate to make reliable estimates of output.

[3] Reported raw gold production but excludes gold contained in copper concentrate.

[4] Based on 55 grams per metric ton silver in copper concentrate.

[5] Reported figure.

[6] Converted from cubic meters assuming a density of 2.0 metric tons per cubic meter.

Sources: National Statistical Office of Mongolia (Ulaanbaatar); Mongolian Statistical Yearbook 2004; Mineral Resources Authority of Mongolia, Output of Mineral Commodities (Minerals Questionnaire 2003-07).

TABLE 2
MONGOLIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity[e]
Cement		Khutul Cement and Lime Factory	Darkhan, Darkhan-Uul Province	500
Coal		Government Coal Mining Enterprise	Baganuur Mine, Tov Province	4,000
Do.		do.	Shivee Ovoo Mine, Dundgovi (Middle Gobi) Province	2,000
Do.		Chinhua-Mak Nariin Sukhait Co. (Sino-Mongolian joint venture)	Nariin Sukhait Mine, Omnogovi (South Gobi) Province	3,000
Do.		SouthGobi Energy Resources Ltd. (Ivanho Mines Ltd., 80%)	Ovoot Tolgoi Mine, Omnogovi (South Gobi) Province	3,000
Copper, Cu in concentrates		Erdenet Mining Corp. (Mongolia-Russia joint venture)	Erdenet, Bulgan Province	130
Gold	metric tons	Boroo Gold Co. (100% Centerra Gold, Inc.)	Bayangol, Selenge Province	10
Do.		Altan Dornod Mongolia Co. Ltd.	Zaamar placer gold deposit along the Tuul River	3
Do.		Mongolrostsvetmet Corp. (Mongolia-Russia joint venture)	do.	2
Fluorspar		do.	Bor-Undur Mine in Darkhan, Khenti Province	300
Do.		do.	Urgen Mine in Dornogobi Province	150
Do.		do.	Airag Mine in Dornogobi Province	150
Molybdenum, Mo in concentrates	metric tons	Erdenet Mining Corp. (Mongolia-Russia joint venture)	Erdenet, Bulgan Province	2,000
Steel		Darkham Metallurgy Plant	Darkhan, Darkhan-Uul Province	100
Tungsten (WO_3 content)	metric tons	A state-owned company	Hovd Gol area, Bayan-Ulgii Province	150
Zinc, Zn in concentrates		Tsait Minerals Co. Ltd. (Sino-Mongolian joint venture)	Sukhe Bator, Sukhbaatar Province	70

[e] Estimated. Do., do. Ditto.

THE MINERAL INDUSTRY OF NEW CALEDONIA

By Susan Wacaster

The archipelago of New Caledonia, which is an overseas territory of France, is located in the South Pacific region of Melanesia. The Geological Survey of New Caledonia, which was created in 2006, performs hydrogeological monitoring of major mining projects within the country and is charged with assessing the cobalt and nickel resources found within the mainland peridotite massifs. In 2008, the United Nations Educational, Scientific and Cultural Organization named the lagoons of New Caledonia to its list of World Heritage sites as they represent one of the most extensive intact reef systems in the world (Eramet S.A., 2007; United Nations Educational, Scientific and Cultural Organization, 2009).

Mining operations in New Caledonia date back to the 1800s. In 2008, despite decreased production caused by a damaging cyclone and decreased global demand for metals, New Caledonia was the world's fifth ranked producer of mined nickel after (in order of tonnage produced) Russia, Canada, Indonesia, and Australia. Mining operations at the Goro nickel deposit were expected to start up in 2009, and the mine expected to become one of the world's leading nickel laterite mines (Kuck, 2009).

Production

In 2008, a total 86,000 metric tons (t) of nickel was produced from 4.7 million metric tons (Mt) of saprolite ore and 16,700 t of nickel was produced from 1.5 Mt of laterite ore for a total of 102,700 t of nickel and 6.2 Mt of ore compared with 125,000 t and 7.6 Mt, respectively, in 2007. In 2008, about 37,500 t of ferronickel and 13,600 t of nickel matte were produced compared with 44,954 t and 13,860 t, respectively, in 2007 (Direction de l'Industrie, des Mines et de l'Energie, 2009).

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Mineral Trade

In 2008, nickel exports decreased by about 9% to 52,195 t compared with 57,431 t in 2007 and 63,149 t in 2006, which resulted in a total 2-year decrease of about 17%. The amount of ferronickel exported in 2008 decreased by about 11% to 35,549 t (nickel content), which was the least amount of ferronickel exported in the 10 years before and including 2008. Nickel matte exports decreased by 2.6% in 2008 compared with those of 2007, but still remained above the level of exports for all other years since 1998, although exact production numbers were unavailable. Exports of ferronickel were received by the European Union (41.8%), Japan and Taiwan (18.2% each), China (whose share increased to 8.0% in 2008 from 5.2% in 2007), India, South Africa, the Republic of Korea (whose share increased to 2.4% in 2008 from 0.6% in 2007), and the United States. France was the only country that received New Caledonian nickel matte (Institut de la Statistique et des Études Économique, 2009, p. 41-44).

Commodity Review

Metals

Nickel.—Société Le Nickel (SLN), which was a subsidiary of the Eramet Group of France, operated five mines in New Caledonia, including the Kouaoua, the Nepoui, the Poum, the Thio, and the Tiebaghi Mines. The company produced ferronickel and nickel matte at the Doniambo metallurgical plant from ores obtained from those mines. Renovation work on the plant's furnace 9, which resulted in a production stoppage from May 25 to September 15, was completed according to schedule. Nickel output at Doniambo reached 51,130 t in 2008. Two of the plant's melting furnaces and two calcination furnaces had been renovated since 2004 as part of Eramet's investment in New Caledonian projects (Eramet S.A., 2009a, p. 14-15).

SLN's Kouaoua mining center is located on the east coast 140 km north of Noumea. The center had a production capacity of about 1 million metric tons per year (Mt/yr) of ore with a total recorded ore production of about 30 Mt of saprolite. The saprolite deposit being worked was located at the summit of the Koeto massif, which is located 20 km from the west coast. The Tiebaghi mining center is located on the west coast 400 km north of Noumea; a new high-performance enrichment unit was opened there in November. The company expected to extend the life of the Tiebaghi deposit by 25% owing to the ability to process lower grade ores. At one time, the Tiebaghi massif was mined for chromium and cobalt, whereas nickel ores were a relatively recent discovery made in the early 1970s. The Thio mining center is located on the east coast in South Province, 120 km from Noumea. Mining began there in 1880 and has been carried out ever since. As of 2007, more than 40 Mt of saprolite containing 900,000 t of nickel had been extracted from the mines at Thio, including the Bomets, the Camp des Sapins, the Dothio, the Kongouhaou, the Ningua, and the Plateau Mines (Eramet S.A., 2007; 2009a).

In 2008, Vale Inco Ltd., which was a subsidiary of Vale S.A. of Brazil, reported that its Goro laterite nickel project was expected to have an annual production capacity of at least 60,000 metric tons per year (t/yr) of nickel oxide sinter and about 4,600 t/yr of cobalt; however, the company planned to begin operations in the first half of 2009 with very limited production and would gradually increase production during the next 4 years. The company reported estimated measured and indicated mineral reserves of 55 Mt and that its total investment in the project was about $4.1 billion. The Goro project had been strongly opposed by local communities and environmental groups at least since the late 1990s. Work stoppages, protests, and problems with financing and permitting all contributed to construction and production delays (Vale S.A., 2009a, p. 35; 2009b).

In 2008, Xstrata plc of Switzerland announced that it had awarded large construction contracts at its Koniambo project. The company expected to process its first ore in the first half of 2012 and would reach a full annual production of 60,000 t of nickel in ferronickel within the next 2 years (Xstrata plc, 2009, p. 67).

Gladstone Pacific Nickel Ltd., which was an Australian mining development company, signed a joint-venture agreement with New Caledonia's Société Minière Georges Montagnat SA (SMGM) in 2007. The joint-venture company, which was called Ouinne SAS, commenced a resource definition drill program in January 2008 at the Ouinne nickel properties in southern New Caledonia. By June, almost 3,000 meters (m) of drilling had been completed, and the company expected to complete at least 9,000 m by the end of the year after receiving additional drill rigs in the third quarter of the year. In January 2009, Gladstone received approval from the Australian Government for construction of a smelter in Central Queensland where the New Caledonian laterite ores would be processed. Although resource estimates were not reported, the company stated that, based upon preliminary data, the New Caledonian resources were of a size and grade that would allow for production for at least 20 years (Gladstone Pacific Nickel Ltd., 2008, p. 12; 2009).

In January 2009, SLN signed a joint-venture agreement with the government of South Province, New Caledonia, to explore and develop the Creek Pernod and the Prony nickel deposits. Ownership of SLN was shared between the Eramet Group, Nisshin Steel Co. of Japan, and the Société Territoriale Calédonienne de Participation Industrielle (STCPI). STCPI represented the interests of South Province. The Government granted a 3-year exploration permit, which could be extended to a maximum of 9 years (Eramet S.A., 2009b).

Outlook

The prices of nickel metal products on the London Metal Exchange increased steadily since about 2001 and reached nearly three times those prices in mid-2007, but then began to drop significantly in mid-2007. By mid-2008, the prices were steadily falling, but were still nearly twice as high as the prices in 2001. Nevertheless, New Caledonia maintained relatively consistent production levels across those years until mid- to late-2008 when, the global recession notwithstanding, such external factors as operational shutdowns and the largest recorded rainfall event since the 1950s contributed to production downturns. New Caledonia generates mining revenue from the production of only a few commodities, so its national economy is susceptible to variations in the demand for those commodities. Some companies with operating facilities and projects in development were required to assess their goals for 2009 from the perspective of slow but positive economic growth. The Government of New Caledonia projected that there would be a market for its products to supply China's steel industry in 2009. The major development projects in New Caledonia, including Vale's Goro and Xstrata's Koniambo projects, are still projected to start production in the near term; however, it remains to be seen how the metals markets will recover and what degree of success those projects will have in the near term.

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TABLE 1
NEW CALEDONIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008[p]
Cement		114,762	119,302	133,074	134,000	NA
Nickel:						
Ore:						
Gross weight	thousand metric tons	7,033	6,445	6,179	7,575 [r]	6,172
Co content[3]		2,726	1,769	1,900	1,920	1,300
Ni content		118,279	111,939	102,986	125,211	102,700
Ferronickel:						
Gross weight		151,296	155,800	162,000	145,000	124,900 [e]
Ni content		43,016	46,738	48,723	44,954	37,500
Nickel matte:						
Gross weight		17,200	18,100	19,300	19,500	18,000 [e]
Ni content		12,164	12,838	13,655	14,842 [r]	13,600

[e]Estimated; estimated data are rounded to no more than three significant digits. [p]Preliminary. [r]Revised.

[1] Table includes data available through October 30, 2009.

[2] In addition to the commodities listed, crude (unspecified) and crushed stone, construction sand, and silica sand for metallurgical use are produced, but available information is inadequate to make reliable estimates of output.

[3] Includes only cobalt contained in mined limonite.

Source: Institute de la Statistique et des Études Économique, New Caledonia, Series Statistiques—Mine—Metallurgie, March 2008; U.S. Geological Survey, Minerals Questionnaire, 2003-06; British Geological Survey, World Mineral Production 2002-05; World Bureau of Metal Statistics, World Metal Statistics, February 2008; and International Nickel Study Group, World Nickel Statistics, Monthly Bulletin, April 2008.

TABLE 2
NEW CALEDONIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Cement	thousand metric tons	Société des Ciments de Numbo	Noumea	150
Cobalt				
In ore and concentrate, Co content		Société Le Nickel (SLN) (Eramet Group, 56%; Société Territoriale Calédonienne de Participation Industrielle (STCPI), 34%; Nisshin Steel Co., 10%)	Kouaoua, Nepoui-Kopeto, Poum, Thio, and Tiebaghi mining centers	2,000
Do.		Société Minière du Sud Pacifique (majority owned by the government of Northern Province, New Caledonia)	Boakaine, Ouaco, Poum, and Poya mining centers	1,000
Nickel:				
In ore and concentrate, Ni content		Société Le Nickel (SLN)	Kouaoua, Nepoui-Kopeto, Poum Thio, and Tiebaghi mining centers	61,500
Do.		Société Minière du Sud Pacifique, including Nickel Mining Corp., and Nouméa Nickel	Baokaine, Ouaco, Kouaoua, Poum, Poya, and Nakety mining centers	35,800
Do.		Société de la Tontouta (Ballande Group)	Moneo and Nakety mining centers	16,000
Do.		Other small nickel mining companies, which include Société Minière George Montagnat SA (SMGM), GEMINI S.A.	Moneo and Nakety-Bogota, and Tontouta mining centers	7,300
In ferronickel, Ni content		Société Métallurgique le Nickel-Société Le Nickel (SLN)	Doniambo, Noumea	60,000
In nickel matte, Ni content		do.	do.	15,000

[e]Estimated. Do., do. Ditto.

THE MINERAL INDUSTRY OF NEW ZEALAND

By Pui-Kwan Tse

New Zealand had more than 600 identified mineral occurrences in 25 different types of mineral deposits. New Zealand's mineral production included gold, iron sand, and silver; such industrial minerals as aggregate (crushed stone and gravel), building and dimension stone, clay, diatomite, feldspar, lime and limestone for agricultural and industrial uses, magnesite, marble, phosphate rock, salt, sulfur, and zeolite; and mineral fuels. The New Zealand mining industry is a small player in the international market compared with its neighboring country Australia.

The Crown Minerals Act 1991 and the Crown Minerals Amendment Act 2003 set the broad legislative policy for the prospecting and exploring for and the mining of Crown-owned (meaning Government-owned on behalf of all New Zealanders) minerals in New Zealand. The Ministry of Economic Development, through the Crown Minerals Group, is responsible for the overall management of all state-owned minerals in New Zealand. The Crown Minerals Group also advises on policy and operational regulation and promotes investment in the mineral sector. The royalty regimes for coal, minerals, and petroleum are defined in the Government mineral program that is reviewed every 10 years. In 2007, the Crown Minerals (Minerals and Coal) Regulations 2007 were enacted to specify the reporting requirements for permit changes and for prospecting and exploration. The regulation took effect on February 1, 2008. The hybrid value-and-profit-based royalty was replaced with a royalty that was solely value based. Under the new law, the royalty for aggregate, coal, and industrial minerals is based on the number of metric tons sold (Ministry of Economic Development, 2008b, p. 30).

In 2008, New Zealand's total exports were valued at $NZ42.9 billion ($34.3 billion), and its total imports were valued at $NZ48.9 billion ($39.1 billion). Australia continued to be New Zealand's main import and export trading partner. The United States and Japan were New Zealand's second and third ranked export markets, respectively. China and the United States were New Zealand's second and third ranked sources of imports, respectively. Mineral fuels accounted for 6.9% of the country's total export value; aluminum and its products, 3.3%; and iron and steel, 0.7%. Mineral fuels were New Zealand's most valuable imported commodities and they accounted for 17.7% of the country's total import value (Statistics New Zealand, 2009).

Minerals in National Economy

New Zealand's mineral resources were dominated by aggregate and gold, which, together, accounted for 80% of the total value of New Zealand's mineral resources. Gold, iron sand, and silver were major metallic commodities that made a significant contribution to New Zealand's economy. Production of other metallic minerals, such as bauxite, copper, lead, and zinc, could potentially be economically feasible if technologies and prices become favorable. Excluding the petroleum industry, the value of New Zealand's mineral production of coal, metals, and industrial minerals accounted for about 1% of the gross domestic product (GDP). The total value of New Zealand's minerals and mineral fuel production accounted for about 2% of the GDP. During fiscal year 2008 (July 2007 to June 2008), New Zealand's total exploration expenditure on minerals and coal was $NZ38.16 million ($30.53 million) and its petroleum expenditure was $NZ1.56 billion ($1.25 billion) (Ministry of Economic Development, 2008a, p. 14-16).

Production

In 2008, production of such mineral commodities as gold, crude oil, silver, and zeolite increased by more than 10% compared with that of 2007. Mineral commodities for which production decreased significantly included bentonite, diatomite, dolomite, liquefied petroleum gas, pumice, serpentine, and silica sand. Data on mineral production are in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities in New Zealand.

Commodity Review

Metals

Gold.—New Zealand's gold production was dominated by Newmont Mining Corp. of the United States and OceanaGold Corp. The Martha gold field is located in Waihi and is owned by Newmont Waihi Gold, which was a subsidiary of Newmont Mining. The Martha open pit mine had been scheduled to close in 2007 but Newmont Mining was evaluating ways to extend mining at the open pit to 2012 and was actively exploring in another part of the region. Mining was started at an underground ore body (the Favona deposit) at the processing plant site in late 2006. In 2008, Newmont Mining's Waihi operation milled a total of 970,000 metric tons (t) of ore, which was nearly twice as much as the 500,000 t produced in 2007, and although the ore grade decreased to 4.8 grams per metric ton (g/t) in 2008 from 5.4 g/t in 2007, the recovery rate increased by 1%. Thus, as a result of the increased output and recovery rate, gold production increased to 4.5 t (144,000 troy ounces) in 2008 from 2.6 t (85,000 troy ounces). Newmont Mining joined with Glass Earth Gold Ltd. to explore a gold prospect southwest of Whangamata and at the Wharekirponga prospect, which is located about 11 kilometers (km) north of the Waihi operation (Newmont Mining Corp., 2009, p. 11).

OceanaGold's Macraes gold project consisted of the Macraes open pit mine and the Frasers underground mine, which started production in January 2008. OceanaGold's Reefton gold project was located about 7 km from Reefton on the west coast of the South Island and the project began operating in 2007. The Reefton project included four open pits—the Empress, the General Gordon, the Globe Progress, and the Souvenir—and a 1-million-metric-ton-per-year (Mt/yr) processing plant. The concentrate was sent by rail to the Macraes pressure oxidation facility for final processing. In 2008, gold production from Macraes increased by 26% to 5.7 t (183,680 troy ounces) and that from Reefton increased by 50% to 2.4 t (76,132 troy ounces). The ore grade through the mill from the Macraes Mine increased by 25% to 1.31 g/t and that from the Reefton Mine decreased by 5% to 2.47 g/t. OceanaGold planned to produce between 8.7 t and 9.3 t of gold in 2009 (OceanaGold Corp., 2009, p. 12-15).

Iron and Steel.—New Zealand's iron ore is mainly titanomagnetite iron sand deposits that extend along 480 km of coastline from Kaipara Harbour south to Wanganui on the west coast of the North Island. Deposits at Taharoa and Waikato North Head were being mined. Iron sand from Waikato North Head was used by New Zealand Steel Ltd. (a subsidiary of BlueScope Steel Ltd. of Australia) which was located at Glenbrook. New Zealand Steel was an integrated steel producer that had a steel output capacity of 650,000 t/yr; the steel was first transferred to a continuous caster and then to a rolling mill to produce flat-rolled steel products. BlueScope signed an agreement to sell its Taharoa operation on the North Island to Hong Kong-based Cheung Kong Infrastructure Holdings Ltd. for NZ$250 million; however, the Government of New Zealand rejected the transaction because the Taharoa operation was considered to be on "sensitive land" and the sale would not produce any substantial and identifiable benefit to New Zealand. The production of Taharoa's iron sands was mainly for export to China and Japan (BlueScope Ltd., 2008).

Mineral Fuels

Coal.—New Zealand's coal resources were estimated to be 15 billion metric tons (Gt), of which about 8.6 Gt was economically recoverable. About 45 coal mines were in operation in New Zealand. Bituminous coal resources are located in the West Coast region of the South Island; subbituminous coal resources are found mainly in the Waikato region of the North Island, as well as in the Otago, the Southland, and the West Coast regions of the South Island. Lignite resources are found in the Otago and the Southland regions of the South Island. New Zealand exported nearly all its bituminous coal output from the South Island. Five underground and 20 opencast mines were operating in 2008 and about 63% of output was from 2 opencast operations at Rotowaro near Huntly and Stockton in the Buller field. State-owned Solid Energy New Zealand Ltd. accounted for about 80% of the country's coal output. In 2008, the country exported 2.56 million metric tons (Mt), which was higher than the 2.01 Mt exported in 2007. The increase in the coal export volume was in response to increased external demand in the first three quarters of 2008. Coal exports went mainly to India and Japan, with a small quantity going to Brazil, Chile, China, South Africa, and the United States. New Zealand imported 607,000 t in 2008, which was lower than the 729,000 t imported in 2007. Imported coal was largely to supply the Huntly powerplant. New Zealand consumed more than 4 Mt of coal during the past several years. The power sector was the leading coal consumer followed by the steel sector (Ministry of Economic Development, 2009a).

Pike River Coal Ltd. started the construction of its Pike River coal mine at about 50 km northeast of Greymouth in the west coast of the South Island in 2006. A 2,300-meter (m) adit was built to reach the estimated recoverable resource of 18 Mt of low-ash coking coal, which was located under Department of Conservation-administered land, with part of it under Paparoa National Park. The mine was designed to produce 1 Mt/yr for 18 years beginning in 2010. The company estimated that the area contained 58.5 Mt of coking coal. The coal seam thickness was 4 m to 9 m. Coal would be transported from the underground mine by a 10.6-km-long slurry pipeline to a preparation plant for dewatering and electronic grading; it would be stockpiled and eventually trucked to rail-loading facilities for transport across the Southern Alps to Lyttelton, and then exported. Owing to technical difficulties, the first shipment of 60,000 t of coking coal would be delayed until the first quarter of 2010 from its originally scheduled delivery date of November 2009. Pike River signed contracts to deliver nearly all its coking coal output through March 31, 2010, to buyers in India and Japan at a cost of $128 per metric ton (Pike River Coal Ltd., 2009).

Solid Energy decided to shut down the Terrace underground coal mine at the end of 2009. In recent years, the mine produced about 45,000 t/yr of thermal coal, and the operation struggled to remain profitable because of high production costs. The shutdown of the mine would not affect the Reefton distribution center, and the company planned to explore other prospects near the town and to consider resuming the operation of mining at Island Block, which contained about 5 Mt of coking coal resources. Solid Energy also decided to close down the Ohai opencast mine in Southland in 2009. Solid Energy continued reviewing some small coal mine operations throughout the country in the face of increasing production costs (Solid Energy New Zealand Ltd., 2009).

Natural Gas and Oil.—New Zealand's natural gas and oil were produced from 21 fields, all of which are located in the Taranaki Basin. Natural gas was produced from 16 fields. In 2008, New Zealand's oil production increased by more than 40% compared with that of 2007. The Tui field, which was owned by Australian Worldwide Exploration Ltd. (AWE) (the operator), Mitsui E&P New Zealand Ltd., Natural Gas Corp. Ltd., and Pan Pacific Petroleum, was put into operation in 2007. This field accounted for the major share of the country's increased oil production. The Tui field produced 63% of the country's total oil output followed by the Pohokura field, 21%; the Maui field, 7%; the Kapuni field, 2%; and others, 7%. The Maari project, which is located 80 km off the South Taranaki coast south of the Maui field and in which OMV New Zealand Ltd. (the operator) held a 69% equity interest, was scheduled to come onstream in 2009 and was expected to produce 50 million barrels of oil in its first year of operation. The Government extended the tax exemption on exploration companies until December 31, 2014, to encourage exploration for offshore hydrocarbons in New Zealand territory. The Marsden Point

Oil Refinery was the country's only oil refinery; it was operated by New Zealand Refinery Co. (Ministry of Economic Development, 2009b).

Outlook

Owing to the global financial crisis, the economy of New Zealand is expected to slow down noticeably in the next several years. Most mineral production is consumed locally with the exception of aluminum, coal, gold, and amorphous silica. Coal, gold, and oil are the leading exported commodities. The development of the mining sector in New Zealand is constrained by the population's environmental awareness, the ecological sensitivity of the country, and New Zealand's location far from major industrial markets. Consistent with these trends, New Zealand's mineral development is expected to continue to increase only gradually.

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TABLE 1

NEW ZEALAND: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
METALS						
Aluminum metal, smelter:						
Primary		342,000	351,449	337,264	351,100 [r]	315,500
Secondary[e]		21,500	21,500	22,000	22,000	22,000
Total		363,500	372,949	359,264	373,100 [r]	337,500
Gold, mine output, Au content	kilograms	10,151	10,583	10,618	10,628 [r]	16,274
Iron and steel:						
Iron sand, titaniferous magnetite, gross weight	thousand metric tons	2,329	2,207	2,146	1,723	2,020
Pig iron[e]	do.	650	652	664	679	600
Steel, crude[e]	do.	850	889	810	845	853
Lead, refinery output, secondary[e]		8,000 [r]	7,000 [r]	7,000 [r]	7,000 [r]	7,000
Silver, mine output, Ag content	kilograms	30,084	43,003	27,221	10,568	31,017
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	1,100	1,050	1,120	1,200 [e]	1,200 [e]
Clays:						
Bentonite		10,050	7,590	3,028	6,154	753
Kaolin, pottery		15,500	15,750	14,864	14,130	12,761
For brick and tile		57,350	41,170	46,667	55,645	34,650
Diatomaceous earth		240	20	142	14	14
Lime[e]		20,000	20,000	20,000	20,000	20,000
Marble[e]		15,000	15,000	15,000	15,000	15,000
Nitrogen, N content of ammonia[e]		124,000 [r]	120,000 [r]	120,000 [r]	125,000	125,000
Perlite		5,600	7,310	3,552	7,873	--
Pumice		280,950	245,080	303,659	354,903	174,729
Salt[e]		70,000	100,000	100,000	100,000	100,000
Sand and gravel:						
Silica sand, glass sand		60,080	65,350	58,705	86,461	48,575
Other industrial sand		1,753,140	1,574,050	2,433,165	1,896,343	1,160,543
For roads and ballast	thousand metric tons	21,720	24,712	23,981	23,782	20,889
For building aggregate	do.	11,362	10,921	8,518	9,601	9,743
Stone:						
Dolomite		12,000	--	1,626	62,770 [r]	16,962
Limestone and marl:						
For agriculture	thousand metric tons	1,913	2,594	2,326	2,180	1,918
For cement	do.	1,839	1,741	1,762	1,965	2,018
For other industrial uses	do.	561	891	944	947	874
Serpentine		60,880	62,320	41,000	45,648	4,494
Dimension		26,110	29,270	22,880	22,934	16,998
Zeolite		11,440	18,790	9,041	17,039	25,800
MINERAL FUELS AND RELATED MATERIALS						
Coal, all grades	thousand metric tons	5,154	5,267	5,768	4,835	4,909
Liquefied petroleum gas	thousand 42-gallon barrels	1,710	1,946	1,786	1,263 [r]	979
Natural gas:						
Gross production	million cubic meters	4,500	4,223	4,100	4,712	4,484
Marketed production	do.	4,114	3,911	3,900	4,310	3,994
Petroleum:						
Crude	thousand 42-gallon barrels	7,625	7,032	6,808	14,873	21,298
Refinery products[e]	do.	34,000	34,000	34,000	34,000	34,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. --Zero.

[1]Table includes data available through September 30, 2009.

TABLE 2
NEW ZEALAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Facilities, major operating companies, and major equity owners	Location of main facilities	Annual capacity^e
Aluminum		Tiwai Point smelter [New Zealand Aluminium Smelters Ltd. (Rio Tinto Alcan, 79.36%, and Sumitomo Chemical Co., 20.64%)]	Southland, Invercargill	350
Cement		Golden Bay Cement (Fletcher Building Ltd.)	Portland	900
Do.		Holcim New Zealand Ltd.	Cape Foulwind, Westport	500
Coal		Stockton open pit mine (Solid Energy New Zealand Ltd., 51%, and Cargill Inc., 49%)	Buller, 35 kilometers northeast of Westport	2,500
Do.		Pike River underground mine (Pike River Coal Ltd.)	50 kilometers northeast of Greymouth	1,000
Do.		Spring Creek underground mine (Solid Energy New Zealand Ltd.)	Greymouth	1,000
Do.		Rotowaro open pit mine (Solid Energy New Zealand Ltd.)	Huntly	1,500
Do.		Huntly East underground mine (Solid Energy New Zealand Ltd.)	do.	500
Do.		New Vale open pit mine (Solid Energy New Zealand Ltd.)	50 kilometers northeast of Invercargill	300
Do.		Ohai open pit mine (Solid Energy New Zealand Ltd.)	Ohai	200
Do.		Terrace underground mine (Solid Energy New Zealand Ltd.)	Reefton	100
Gold	metric tons	Newmont Waihi Gold (subsidiary of Newmont Mining Corp.)	Waihi	5
Do.	do.	Macraes gold project (OceanaGold Corp.)	Otago	6
Do.	do.	Reefton gold project (OceanaGold Corp.)	Reefton	3
Iron and steel:				
Iron ore		New Zealand Steel Ltd. (BlueScope Steel Ltd.)	Taharoa, 150 kilometers south of Auckland	1,300
Do.		do.	Waikato North Head, 30 kilometers south of Auckland	1,000
Steel		do.	Glenbrook	650
Do.		Otahuhu Mill [Pacific Steel Group (Fletcher Building Ltd.)]	Auckland	300
Kaolin		Imerys Tableware New Zealand Ltd.	80 kilometers northwest of Whangarei	25
Petroleum refinery	barrels per day	Marsden Point Oil Refinery (New Zealand Refinery Co., operator)	Marsden Point	95,000
Salt		Dominion Salt Ltd.	South of Blenheim	70
Silver	metric tons	Newmont Waihi Gold (Newmont Mining Corp.)	Waihi	30
Do.	do.	OceanaGold Corp.	Otago	1

^{e}Estimated. Do., do. Ditto.

THE MINERAL INDUSTRY OF PAKISTAN

By Chin S. Kuo

Pakistan is rich in such mineral resources as coal, copper, iron ore, limestone, and salt. Copper and iron ore resources are large and significant in terms of deposits already discovered. New high-grade iron ore deposits were estimated to contain 400 million metric tons (Mt) of ore in Balochistan and Northwest Frontier Provinces. The country also is known to have moderate oil and gas reserves estimated to be 289 million barrels and 792 billion cubic meters, respectively (U.S. Energy Information Administration, 2009). In 2008, Pakistan's economy was dominated by the services, industrial, and agriculture sectors, which accounted for 53%, 27%, and 20% of the gross domestic product (GDP), respectively. Industrial output grew at a rate of 20%. Mining and quarrying accounted for 12% of the industrial production (State Bank of Pakistan, 2008).

Minerals in the National Economy

The value of output from the mineral industry accounted for 3.1% of the GDP, which posted a growth rate of 5.8% in 2008. Employment in the mineral industry accounted for 1.6% of the labor force of 50 million. Exploitation of energy resources had been slow owing to a shortage of capital and political instability. As a result, energy imports, such as crude oil and petroleum products, accounted for about 30% of the country's total imports in the past several years. Weak demand in the world market for Pakistan's mineral products and raw materials and uncertain domestic policies contributed to the country's decreased exports and high trade deficit.

Government Policies and Programs

The National Mineral Policy (1995) provides the institutional and regulatory framework for ensuring an equitable and internationally competitive fiscal regime. The goal of the policy is to expand mining sector activities and attract foreign investment. Because of the importance of minerals to the development of remote areas of the country, and thus to alleviating poverty, the Government has made development of the mineral sector a national priority (Ministry of Petroleum and Natural Resources, 2007).

Production

Pakistan produced a variety of industrial minerals, including aragonite, barite, celestite, clays, gypsum, limestone, and salt. Indigenous limestone was used mainly in the cement industry. Metallic minerals mined included bauxite, chromite, copper, and iron ore. Copper ore was mined at Chaghi by Saindak Metals Ltd. Pakistan's oil production was not sufficient to meet its domestic demand. Output of natural gas came from large fields at Mari and Sui (table 1).

Structure of the Mineral Industry

The Mineral Department of the Ministry of Petroleum and Natural Resources is responsible for Pakistan's exploration, planning, development, and operation of mining ventures. State-owned companies control the production and marketing of chromite, coal, copper, iron ore, and steel. Private-sector companies are allowed to own and produce nonfuel minerals—mainly industrial minerals, including cement. The Ministry itself is responsible for the exploration and production of hydrocarbons and for the transmission and distribution of natural gas (table 2).

Commodity Review

Metals

Copper and Gold.—Tethyan Copper Co., which had a 75% interest in the Reko Diq project at Chaghi in Balochistan Province, was owned by Barrick Gold Corp. of Canada and Antofogasta PLC of Chile. The government of Balochistan Province held the remaining 25% interest. The porphyry deposit at Reko Diq was estimated to contain 12.3 Mt of copper and 650 metric tons (t) of gold. The project was in the prefeasibility stage, and the prefeasibility study was scheduled to be completed in the third quarter of 2009. Work on a full feasibility study had begun and was expected to be completed in the first half of 2010. Production of 250,000 metric tons per year (t/yr) of copper and 12 t/yr of gold was planned (Barrick Gold Corp., 2008).

Saindak Metals Ltd., which was wholly owned by the Government, produced copper, gold, silver, and magnetite concentrate from the copper-gold project in Chaghi District in Balochistan Province. The project was being run by Metallurgical Construction Corp. (MCC) of China on a 10-year lease, which was due to expire in September 2012. Under the lease agreement, MCC paid an annual rent of $500,000 and a 50% share of copper sales to the Government (Free Library, The, 2009).

Iron and Steel.—In 2008, about 15,000 t of iron ore from Chaghi was supplied by AMCO Minerals (a local company) to Pakistan Steel Mills Corporation (Pvt) Ltd. (PSM) to be blended with the imported iron ore to meet PSM's requirements. PSM imported iron ore and coke from Australia, India, and Iran. The steel sector faced problems owing to high iron ore prices in the international market. Iron ore reserves in Pakistan's Punjab Province were 350 Mt at a grade of 30% iron content in Chichali and Kalabagh, Mianwali District; 200 Mt at a grade of 30% to 35% iron in Kallat District; 110 Mt at a grade of 60% iron in Kirana, Sargodha District. Iron ore reserves in Northwest Frontier Province were 100 Mt at a grade of 25% to 35% iron in Nazampur District and 66 Mt at a grade of 30% to 34% iron in Pezu District. PSM was the only integrated steel plant in Pakistan; the plant had the capacity to produce 1.1 million metric tons per year (Mt/yr) of steel (Business Recorder, 2008).

A consortium of four local steel manufacturers planned to develop iron ore deposits at Chiniot and Kalabagh and to establish a steel plant with a capacity of 1 Mt/yr at Kalabagh, Punjab Province. The consortium comprised Ittehad Steel Mills, Mughal Steel, Pak Steel, and Star Cotton Corp. A Chinese company had expressed interest in transferring technology related to the extraction of iron ore. Issues that needed to be resolved were the acquisition of land leased and the development of infrastructure, including gas and powerplants, rails, roads, and other infrastructure-related facilities. In Pakistan, 20% of steel demand was met by domestic sources and the remaining 80% was met through imports (UrbanPK.com, 2008).

Lead and Zinc.—Hunan Zhuzhou Nonferrous Metals Corp. Ltd. of China planned to start production at its partly owned lead and zinc mine at Duddar in the Lasbela District in mid-November. The mine was designed to produce 100,000 t/yr of zinc in concentrate and 32,000 t/yr of lead in concentrate. All the lead and zinc concentrate would be supplied to the company's smelter in China (Reuters India, 2008).

Industrial Minerals

Stone, Dimension.—Pakistan is endowed with high-quality marble reserves. In particular, Ziarat in Northwest Frontier Province has rich reserves of the best-quality marble in the world; this marble was in great demand in the international market. However, the country was not benefiting from the demand for the marble owing to the lack of modern practices used in the quarrying and processing of the marble. The worsening security situation in the quarried area was also a significant concern. The mines also were disadvantaged by large losses of material that resulted from using blasting in production. The Government was considering increasing the country's exports of dimension stone and value-added products made from dimension stone as a means of strengthening the national economy (Stone Roc, 2008).

Mineral Fuels

Coal.—Oracle Coalfields plc reported that Deep Rock Drilling (pvt) Ltd. began drilling the first of a seven-hole program on Block VI of the Thar coalfield in the Province of Sindh. The goal of the program was to validate the drilling results of the China North East Geological Survey Bureau, which had completed a 35-hole drilling program in 2005, and to bring Block VI to an internationally recognized standard. A total length of 9,852 meters (m) was drilled, of which 5,986 m was cored. All holes were geophysically logged, and 271 lignite samples were analyzed for quality (PLUS Markets Group, 2008).

Proposals were being sought for a feasibility study of power generation based on coal from two leases in the Lakhra coalfield. Habibullah Mines Ltd. planned to modernize its coal mining operations in anticipation of increasing its coal supply to the power generation project. The feasibility study would help determine which combustion technology and which plant configuration [two 75-megawatt (MW) units or a single 150-MW unit] should be used. Both decisions would be influenced by the quality of the coal that would be supplied to the plant (U.S. Trade and Development Agency, 2008).

The Government approved proposals for five power projects that would have a combined capacity of 1,365 MW. The approved proposals were for three power projects with a combined capacity of 929 MW that would be constructed by independent power producers and two rental plants with a combined capacity of 436 MW. The independent power projects would come onstream in December 2009; the rental plants would come onstream 6 to 7 months thereafter (Alexander's Gas & Oil Connections, 2008b).

Natural Gas.—OMV of Austria farmed in to two exploration blocks operated by Pakistan Petroleum Ltd. (PPL) and took over 30% of the Kalat Block and 15% of the Barkhan Block in southwestern Pakistan. The Government planned to sell a 51% controlling interest in PPL. OMV, which was Pakistan's leading foreign natural gas producer, was considering acquiring the 51% stake in PPL (Petroleum Economist, 2008).

Three hydrocarbon discoveries were made in Sindh Province in 2008. Petronas Carigali (Pakistan) drilled its Saqib-1A well on the Mubarak Block to 3,605 m and discovered gas and condensate. Oil and Gas Development Co. Ltd. (OGDCL) drilled its Moolan North-1 well in the Lashari development and production lease to 2,329 m and discovered oil. OGDCL also drilled its Pakhro-1 well on the Nim Block to 3,692 m and found gas and condensate (Alexander's Gas & Oil Connections, 2008d).

A joint venture led by Eni Pakistan Ltd. began gas production from the Badhra field, which is located southeast of the Bhit field in Sindh Province, and commissioned the third train at the Bhit gas treatment plant. The $50 million development and acceleration project would boost the Bhit plant's capacity by 17% to 9 million cubic meters per day. The joint venture was composed of Eni Pakistan Ltd. (40%), Kirthar Pakistan BV (28%), OGDCL (20%), PKP Kirthar 2 BV (6%), and PKP Kirthar BV (6%) (Oil and Gas Journal, 2008a).

Gas production continued at the Chachar field in which Tullow Oil plc of the United Kingdom had a 75% interest, whereas output at its Sara/Suri field decreased and was near the end of its life. In September 2008, Tullow started seismic operations on the Kalchas Block and transferred operatorship of the Kohat Block to OGDCL. A drilling operation was expected in 2010 (Tullow Oil plc, 2009).

The Government approved a plan to privatize OGDCL's Qadirpur gasfield with the sale of 37% of the Government's shares along with the transfer of operational control. OGDCL was currently the operator and held a 75% share. PPL held a 7% interest. A total of 29 wells had been drilled in the Qadirpur field, of which 24 were producing. At the end of the first phase of development, the field's capacity was 14.15 million cubic meters per day. By December 2007, the capacity had increased to 16.98 million cubic meters per day. The gas was supplied to Sui Southern Gas Co. Ltd. (Oil and Gas Journal, 2008c).

Owing to limited gas production, the share of natural gas in the total energy mix declined to 48.5% in 2007 from 50.4% in 2006. Gas production was only 113 million cubic meters per day whereas consumption was 139 million cubic meters per day.

Increasing the volume of imported gas was viewed as the most viable solution to overcoming the energy shortage (Alexander's Gas & Oil Connections, 2008c).

Iran and Pakistan reached an agreement to form a joint venture to build a 2,700-kilometer gas pipeline from the South Pars field in Iran to Multan Province in Pakistan. The joint venture would secure the necessary financing for the project, which was estimated to be $7.5 billion (Alexander's Gas & Oil Connections, 2008a).

Petroleum.—Pakistan planned to auction fields for oil and gas exploration under the new Petroleum Exploration and Production Policy of 2007. A clause in the new policy allows the Government to resell leased land after its expiry. The clause is intended to ensure that leaseholders develop their fields in a timely manner. Another clause concerns the levying of a windfall profits tax. The country's consumption of oil was on the rise. The increase was led by increased consumption of furnace oil by the power sector (Alexander's Gas & Oil Connections, 2008c).

Pakistani refineries reduced gasoline production in September 2008 following changes in the pricing formula, the availability of stocks, and a drop in consumption. National Refinery Ltd. reduced its output to between 9,000 and 10,000 metric tons per month (t/mo); Pakistan Refinery Ltd., to 7,500 t/mo; Attock Refinery Ltd., to between 21,000 and 22,000 t/mo; and Bosicor Refinery Ltd., to 4,000 t/mo (Oil and Gas Journal, 2008b).

TransAsia Refinery Ltd. planned to relocate a 100,000-barrel-per-day refinery from Naples, Italy, to Port Qasim near Karachi. The company sought formal approval from the Environmental Protection Agency and the government of the Province of Sindh to implement the project. The company awarded a contract to Descon Engineering of Lahore for the engineering, design, and construction of products and utilities pipelines, crude and export products storage-handling facilities, and utilities and offsite facilities. The project was scheduled to be completed by April 2010 (Oil and Gas Journal, 2008d).

Outlook

Pakistan's newly discovered iron ore deposits and increased production of iron ore are expected to reduce the imports of iron ore for blending from abroad and provide sufficient supply of iron ore for a second steel mill that was planned to be built in the near future. The Reko Diq project is still being developed and is expected to produce copper and gold in 2010 in addition to copper output from the Sandaik Metals project in Chaghi. Abundant lignite found in the Thar District in Sindh Province is expected to be used in coal-fired powerplants being planned or under construction to increase the power-generating capacity in the next 2 to 3 years. The Government encourages the independent power producers to generate electricity by using natural gas, which also is abundant in the country.

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TABLE 1
PAKISTAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006[e]	2007[e]	2008[e]
METALS						
Bauxite, gross weight		4,847	6,504	7,000	7,500	7,600
Chromium ore:						
Gross weight		29,230	73,000 [r]	98,000 [r]	108,000 [r]	110,000
Cr_2O_3 content[e]		13,200	32,900 [r]	44,100 [r]	48,600 [r]	49,500
Copper, mine, Cu content		15,000	17,700	19,100	18,800 [r]	18,700
Iron and steel:						
Iron ore, gross weight[e]	thousand metric tons	50	50	130 [2]	207	250
Pig iron	do.	84,946	104,278	105,000	106,000	105,000
Steel, crude	do.	1,145 [r]	825 [r]	1,040 [r, 2]	1,090 [r, 2]	1,100
Lead, refined, secondary[e]		3,000 [2]	3,200	3,100	3,000	3,000
INDUSTRIAL MINERALS						
Abrasives, natural, emery[e]		150	150	150	150	150
Barite		44,207	42,087	45,169 [2]	44,000	43,000
Cement, hydraulic[e]	thousand metric tons	15,000	17,000	20,652 [2]	21,000	22,000
Chalk		7,735	8,146	6,039 [2]	6,000	5,800
Clays:						
Bentonite		6,316	15,671	23,773 [2]	24,000	25,000
Fire clay		192,728	253,501	332,136 [2]	340,000	330,000
Fuller's earth		13,986	17,001	18,000	19,000	20,000
Kaolin, china clay		25,204	37,732	38,000	39,000	40,000
Other[e]		212,000	215,000	216,000	218,000	220,000
Feldspar		30,373	25,032	15,085 [2]	22,000	20,000
Fluorspar[e]		1,026 [2]	1,040	2,839 [2]	1,500	1,400
Gypsum, crude		467,065	552,496	649,944 [2]	620,000	640,000
Magnesite, crude		6,074	3,029	1,884 [2]	1,400	1,600
Nitrogen, N content of ammonia		2,114,000	2,114,000	2,200,000	2,250,000	2,300,000
Phosphate rock:						
Gross weight		4,614	2,687	2,048 [2]	1,800	1,600
P_2O_5 content[e]		840	490	370	320	290
Pigments, mineral, natural, ocher[e]		5,000	5,500	5,500	6,000	6,000
Salt:						
Rock	thousand metric tons	1,640	1,648	2,008 [2]	1,620	1,700
Marine	do.	12	14	13	13	13
Total	do.	1,652	1,662	2,020	1,630	1,710
Sodium compounds, n.e.s.:[e, 3]						
Caustic soda		230,000	250,000	240,000	230,000	240,000
Soda ash, manufactured		240,000	260,000	250,000	260,000	250,000
Stone:						
Aragonite and marble		993,558	1,280,304	2,420,737 [2]	2,500,000	2,300,000
Dolomite		297,419	199,653	252,390 [2]	260,000	270,000
Limestone	thousand metric tons	13,150	14,857	22,420 [2]	25,000	24,000
Other, as "ordinary stone"	do.	4	6	5	5	5
Strontium minerals, celestite		570	1,855	1,466 [2]	1,600	1,700
Sulfur, native		23,873	24,158	23,000	22,000	21,000
Talc and related materials, soapstone		52,483	20,564	24,529 [2]	28,000	26,000

See footnotes at end of table.

TABLE 1—Continued

PAKISTAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006[e]	2007[e]	2008[e]
MINERAL FUELS AND RELATED MATERIALS						
Coal, all grades	thousand metric tons	3,325	3,367	4,313 [2]	4,000	4,200
Coke	do.	--	--	242 [2]	260	250
Gas, natural:						
Gross production	million cubic meters	34,063	38,089	39,813 [2]	40,000	41,000
Marketed production, sales[e]	do.	30,000	34,000	36,000	37,000	38,000
Natural gas liquids[e]	thousand 42-gallon barrels	650	700	700	750	750
Petroleum:						
Crude	do.	22,625	24,119	24,275 [2]	25,000	26,000
Refinery products:						
Gasoline	do.	9,616	9,959	10,000	11,000	12,000
Jet fuel	do.	7,432	8,833	9,000	9,800	9,900
Kerosene	do.	1,794	1,511	1,300	1,100	1,000
Distillate fuel oil	do.	24,315	26,857	28,000	30,000	32,000
Residual fuel oil	do.	22,794	23,346	23,000	23,500	23,000
Lubricants	do.	1,334	1,401	1,500	1,500	1,600
Other	do.	9,251	10,264	12,000	14,000	15,000
Total	do.	76,536	82,171	84,800	90,900	94,500

[e] Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. -- Zero.

[1] Table includes data available through August 17, 2009.

[2] Reported figure.

[3] Not elsewhere specified.

TABLE 2
PAKISTAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Barite		Bolan Mining Enterprises	Khuzdar, Balochistan Province	24
Do.		Razvi Mining (Private) Ltd.	Gandori, Kalan, and Retri	30
Cement		Askari Cement Co. Ltd.	Nizampur	1,200
Do.		Attock Cement Pakistan Ltd.	Hub Chowki	800
Do.		Cherat Cement Co. Ltd.	Nowshera	750
Do.		Dandot Cement Co. Ltd.	Dandot	500
Do.		Fauji Cement Co. Ltd.	Jhang Bahtar	1,170
Do.		Gharibwal Cement Ltd.	Jhelom	540
Do.		Javedan Cement Ltd.	Karachi	600
Do.		D.G. Khan Cement Co. Ltd.	Chakwal and Dera Ghazi Khan	1,650
Do.		Kohat Cement Co. Ltd.	Kohat	700
Do.		Lucky Cement Ltd.	Pezu	1,660
Do.		Maple Leaf Cement Factory Ltd.	Daudkhel	1,500
Do.		Pakistan Cement Co.	Between Islamabad and Lahore, Punjab Province	2,200
Do.		Pioneer Cement Ltd.	Chenki	1,300
Do.		Thatta Cement Co. Ltd.	Thatta	300
Do.		Zeal Pak Cement Factory Ltd.	Hyderabad	1,080
Chromite		Pakistan Chrome Mines Ltd.	Gwal, Khanozai, Muslim Bagh, and Nisai	20
Coal		Sindh Coal Authority	Dadu, Sindh Province	4,000
Do.		do.	Thar, Sindh Province	NA
Copper, metal		Saindak Metals Ltd.	Chaghi, Balochistan Province	22
Gas, natural	million cubic meters per day	Pakistan Petroleum Ltd. (PPL)	Adhi, Punjab Province; Kandhkot and Mazarani, Sindh Province; and Sui, Balochistan Province	24
Do.	do.	Oil and Gas Development Co. Ltd. (OGDCL)	37 oilfields and gasfields	31
Petroleum, crude	42-gallon barrels per day	Pakistan Petroleum Ltd. (PPL)	Adhi, Punjab Province	1,600
Do.	do.	Oil and Gas Development Co. Ltd. (OGDCL)	37 oilfields and gasfields	46,000
Petroleum, refined	do.	Bosicor Pakistan Ltd.	Karachi	30,000
Do.	do.	Pak-Arab Refinery Co. Ltd.	Mahmood Kot, Punjab Province	100,000
Steel, crude		Pakistan Steel Mills Corporation (Pvt) Ltd. (PSM)	Karachi	1,100

[e] Estimated. Do., do. Ditto. NA Not available.

THE MINERAL INDUSTRY OF PAPUA NEW GUINEA

By Susan Wacaster

Papua New Guinea is composed of a group of islands that are situated northeast of Queensland, Australia. The country has 20 Provinces, 1 autonomous region, and a capital district; the Provinces are divided into 4 administrative regions. The New Guinea mobile belt is a metallogenic belt that spans the mainland and has hosted globally significant metal deposits. The islands have such mineral resources as cobalt, copper, crude petroleum, gold, molybdenum, natural gas, nickel, platinum, and silver.

The country, areas of which were unknown to the world until the early 1900s, did not gain political independence until 1975. From the 1880s through the 1940s, political control of the New Guinea Islands was held at different times by Australia, Britain, and Germany. The German administration focused on scientific research in the area rather than prospecting for economic resources, whereas the opposite was true of the Australian administration. The first gold production, which initiated a rush of Australian miners, came from Sudest Island in 1888, but the eluvial and shallow placer gold was soon mined out. Further exploration led to the discovery of gold in other locations, and by the early 1900s, lode mining had begun on Misima, Sudest, and Woodlark Islands. The years between World Wars I and II were boom years for gold prospecting and production. The Morobe Goldfield produced greater than 100,000 kilograms (kg) of alluvial gold, and mining provided significant revenue to the country. Copper ore was mined from 1907 to 1926 near Port Moresby and transported to a smelter near the Tahira Inlet, and two other unnamed mines provided ore for another smelter from 1938 to 1942. Mineral exploration was promoted by the Government in the late 1950s, and in the 1960s, the Panguan copper and gold porphyry was discovered. This deposit produced 30 million metric tons (Mt) of copper and nearly 300,000 kg of gold by the late 1980s. In recent years, as a country with an emerging economy and a relatively large mineral endowment, Papua New Guinea's economy has relied upon commodity exports. In 2008, although the country did not place among the world's highest ranked copper producers, it was estimated to be the world's fifth ranked producer of gold after Chile, South Africa, the United States, and Australia (Harmony Gold Mining Co. Ltd., 2008, p. 47; Coppermoly Ltd., 2009, p. 2; Marengo Mining Ltd., 2009, p. 2, Mineral Resources Authority of Papua New Guinea, 2009; U.S. Department of State, 2009).

Minerals in the National Economy

From 2003 through 2006, the mining, quarrying, and petroleum sector contributed between 17.9% and 27.3% to the nominal gross domestic product (GDP) of Papua New Guinea, with a slight decrease to 26.2% in 2007. Despite a global economic downturn in the second half of 2008, economic growth was recorded in Papua New Guinea for the year. Conversely, all sectors of the economy recorded increases except the mining and the building and construction sectors. The total real GDP grew by 7.2% and the nonmineral GDP grew by 7.9% compared with 6.5% and 7.3%, respectively, in 2007. Despite the decrease in the mining GDP for the year, increased exports, which were driven by high international commodity prices in the first half 2008, contributed to economic growth. In the 12 months prior to September 2008, the total nominal value of sales in the private sector increased by 12.9%, whereas excluding the mineral sector, it increased by 25.6% (Bank of Papua New Guinea, 2009, p. 1, 31; International Monetary Fund, 2009, p. 22).

In the mineral sector, the nominal value of sales decreased by 24.1% in the third quarter of 2008 compared with a decrease of 7.5% in the previous quarter. The decrease reflected lower prices and decreased production of copper and decreased production of gold in the country as a whole; however, some regions did show growth in the mining industry. In the Islands region, the nominal value of total sales increased by 24.2% in the third quarter of 2008 compared with a decrease of 7.2% in the previous quarter; the increase was reportedly the result of increased sales in the mineral sector. In the Highlands region, the nominal value of total sales increased by 6.6% in the third quarter of 2008 compared with an increase of 8.8% in the previous quarter; this increase was also attributed to the higher prices for and production of gold. In the Southern region, however, the nominal value of sales decreased by 43.3% in the third quarter of 2008 compared with a decrease of 5.1% in the previous quarter. The decrease there was attributed to lower prices and reduced exports of copper ores (Bank of Papua New Guinea, 2009, p. 9-10).

Government Policies and Programs

The Mining Act of 1992 and the Mining Safety Act of 1977, which are administered by the Department of Mining, are the laws that regulate mining in Papua New Guinea. The Mining Act provides for the following four types of licenses: exploration leases, which are granted for a period of up to 2 years and are extendable by periods of up to 2 years; mining leases, which are generally issued for small- to medium-scale mining for an initial period not to exceed 20 years and which can be extended by up to 10 years; special mining leases, which are issued to large-scale projects for an initial period of 40 years and which are renewable by terms of up to 20 years (the holder must be a party to a mining development contract with the state and issuance is subject to public forum); and alluvial mining leases, which are generally used by Papua New Guineans for small-scale mining activities (Resource Information Unit, 2009, p. 91).

In May 2008, the Government of Papua New Guinea refused to renew Frontier Resources Ltd. of Australia's exploration license at the company's Kodu copper, gold, and molybdenum project. The company's conceptual mining study determined that a 200-Mt operation [20 million metric tons per year (Mt/yr) for 10 years] was economically viable, and a feasibility study was to follow. In 2007, Frontier reportedly had received approval from the Government to proceed with the project. The company reported that the Government later decided that concerns about a native walking path, called the Kokoda Track, were more important to the national interest than the mine and cited the National Executive Council's concerns about water and power supplies to Port Moresby. The Kokoda Track would have to be diverted to accommodate the mine and there was debate about the degree to which the diversion would affect visitors and communities. The trail held historical significance, as it represented the location where, in 1942 (when Papua New Guinea was an Australian Protectorate), Australian troops recaptured Kokoda after a World War II Japanese invasion. The trail has become a regularly visited site by trekkers and tourists. Some opponents of the mine claimed that plans to re-route the Kokoda Track would desecrate the trail. Villagers have also blocked the trail in protest against their having received little or no benefits from the fees collected from visitors. Frontier reported that an independent initial environmental assessment that was commissioned by the company found the National Executive Council's claims to be baseless. Legal proceedings were initiated by the company in October 2008 (Marshall, 2007; Fox, 2009; Frontier Resources Ltd., 2009, p. 1-9; Kokoda Track Foundation, 2009).

Production

The International Monetary Fund (IMF) reported the following production volumes for Papua New Guinea as of September 2008: crude oil, 8.6 million barrels (Mbbl); copper, 142,600 metric tons (t); and gold, 44,000 kg compared with 2007 yearend total production volumes of 13.8 Mbbl, 199,400 t, and 57,500 kg, respectively. The value of those commodities produced as of September 2008 was recorded as follows: crude oil, $1,002 million; copper, $1,110 million; and gold, $1,258 million compared with $1,018 million, $1,424 million, and $1,254 million, respectively, in 2007 (International Monetary Fund, 2009). To estimate yearend totals for the production of copper, crude petroleum, and gold in 2008, 2007 and 2008 export volumes and 2007 total production volumes were used. According to the Central Bank of Papua New Guinea, the country exported about 13.6 Mbbl of crude petroleum in 2007 (an estimated 11.7% decrease recorded between 2007 and 2008) and, according to the IMF, the country produced about 13.8 Mbbl of crude oil the same year. If so, about 189,000 barrels (bbl), or about 1.4%, of the country's petroleum was refined or retained domestically. Assuming the same percentage of crude petroleum was directed for domestic use in 2008, an estimate of the country's total production for the year would be about 12.4 Mbbl. Following the same procedure for copper (0.54% retained for domestic use) and gold (1.03% retained for domestic use), the estimated yearend production volume of copper and gold would be 186,800 t and 64,000 kg, respectively.

Structure of the Mineral Industry

In March, Allied Gold Ltd. of Australia signed a letter of intent with Barrick Gold Corp. of Canada that gave Barrick Gold the option to acquire up to 70% interest in Allied Gold's exploration licenses on Big Tabar and Tatau Islands. Big Tabar and Tatau Islands host 19 identified gold and gold-copper prospects on which little or no exploratory drilling had been done. Barrick Gold would be required to fund $A8 million of exploration within 4 years to earn a 51% interest, with another $A12 million required within the next 4-year period to earn a 70% interest in the exploration license (Allied Gold Ltd., 2008, p. 3-13).

BacTech Mining Corp. of Canada announced that it had reached an agreement with Yamana Gold Inc. of Canada to acquire its 33% stake in two refractory gold projects in Papua New Guinea (refractory gold is a high sulfide gold ore that requires oxidation of the sulfides to smelt the gold). Gold Aura Ltd. of Australia was the operator and held a 67% share of the ownership. A new joint-venture company was to be created between BacTech and Gold Aura to replace the previous arrangement between Gold Aura and Yamana. To increase its share to 43%, BacTech would pay Can$1 million to Gold Aura during a 2-year period and would have an option to increase its ownership to 50%. The properties included in the deal were the Gameta property, where Gold Aura was conducting an infill definition drilling program, and the Wapolu property, which would be drilled further once a Gameta feasibility study was begun. BacTech had been recognized for using bacteria in the processing of precious and base metals from complex refractory ores and concentrates. Until 2002, the company had focused on licensing its technology to mining companies. In 2003, the company began to acquire mining projects where it could directly apply the technology. The purchase of the Papua New Guinea properties was the company's first such project (BacTech Mining Corp., 2009, p. 1-6).

Harmony Gold Mining Co. Ltd. of South Africa completed a joint-venture agreement with Newcrest Mining Ltd. of Australia. By contributing a maximum of about $525 million in two stages, Newcrest was to earn a 50% interest in Harmony's Papua New Guinea assets, including the Hidden Valley gold and silver project, the Wafi Golpu copper and gold deposit, and more than 3,400 square kilometers (km^2) of Harmony's exploration holdings in Morobe Province. The Morobe mining district, although still relatively unexplored, was reported to have a known mineral endowment of more than 559,000 kg of gold, about 3 million kilograms (Mkg) of silver, 1.8 Mt of copper, and 21,300 t of molybdenum. By November 2008, it was reported that several groups of citizens had sought court orders to halt the feasibility studies at the Wafi gold project in the Bulolo district of Morobe Province. Exploration had reportedly stopped while talks were being carried out in Port Moresby between landowner groups, who claimed that the 50,000 hectares of the Wafi gold project belonged to them, and Government authorities. By early 2009, a situation escalated to one of lethal violence between two tribes who disputed ownership rights of gold-bearing land associated with a National Park and the Hidden Valley Mine. The event left hundreds homeless from fires and led to three deaths (Harmony Gold Mining Co. Ltd., 2008, p.13, 42-43, 47; Indigenous Portal, 2009; Solomon Star News, 2009).

Lihir Gold Ltd. announced that it would further expand its Lihir Island processing plant to increase the plant's gold production capacity to about 31,000 kg by 2012. Construction was to begin in the first quarter of 2009 (Lihir Gold Ltd., 2009, p. 8-10).

Mineral Trade

In 2008, the total value of Papua New Guinea's exported goods was about $6 billion, which was a 9.7% increase compared with the value in 2007. The top five ranked countries to receive exports from Papua New Guinea in 2008 were Australia (40%), Japan (16.8%), Germany (8.2%), Philippines (7.8%), and China, excluding Hong Kong (3.3%) (Bank of Papua New Guinea, 2009, p. 14; International Monetary Fund, 2009, p. 37).

The value of exported minerals, including petroleum, was about $4.7 billion in 2008, or nearly 80% of total exports, which was a 70.1% increase compared with the value in 2007. The increase was attributed to higher prices for gold and crude oil combined with a higher export volume of gold, which offset decreases in the export price of copper and decreases in the export volumes of copper and crude oil. Crude oil exports were valued at $1.4 billion, which was a 17.5% increase compared with exports in 2007, and they accounted for 30% of total goods exported in 2008 compared with 21.2% in 2007. About 12.2 Mbbl of petroleum was exported in 2008, which was an 11.7% decrease compared with exports in 2007. The decrease was attributed to lower production rates because of the natural decline from wells at the Gobe Main, the Moran, and the South East Gobe oil projects, which offset increased production from the Kutubu oilfield. The average export price of crude oil from Papua New Guinea increased by 33.3% in 2008 compared with the price in 2007. Export receipts of refined petroleum products from InterOil Corp.'s Napanapa oil refinery in 2008 were about $193 million, which was a 1.4% increase compared with the value in 2007, and accounted for 3.3% of total goods exported in 2008 compared with 3.6% in 2007 (Bank of Papua New Guinea, 2009, p. 14-15).

Mineral export receipts, excluding crude oil, accounted for 54.1% of the total exported goods in 2008 compared with 56.3% in 2007 (Bank of Papua New Guinea, 2009, p. 14-15). About 63,300 kg of gold was exported in 2008, which was a 10.1% increase compared with exports in 2007. That increase was attributable to increased production from the Lihir Mine, the Ok Tedi Mine (which extracted higher grade ore in 2008 than in 2007), and the Porgera Mine. About 186,000 t of copper ore was exported in 2008, which was a 6.9% decrease compared with the amount in 2007. That decrease was attributable to lower production and shipment of copper ore from the Ok Tedi Mine. Because more than 70% of Papua New Guinea's exports were mineral products, and given that mineral exports accounted for more than 50% of the country's GDP in 2008, the effects of the global economic downturn of 2008 could be directly observed in the case of Papua New Guinea's trade both by the increased production and export of gold with increasing gold prices, and by the decreased production, export, and prices of copper. International demand for gold increased among investors looking for a safe haven for capital, as did gold prices, and as international copper demand declined in the latter part of 2008, so did the production, export, and prices of copper. Alternatively, in the petroleum sector, as crude petroleum prices increased dramatically in the second half of 2008, demand for petroleum and petroleum products decreased, as did exports and production (Bank of Papua New Guinea, 2009, p. 14-15, 25).

Commodity Review

Metals

Copper, Gold, Molybdenum, Silver, and Tellurium.—Coppermoly Ltd. began drilling and trenching on its copper, gold, molybdenum projects, including the Simuku and the Mt. Nakru properties on the island of New Britain. At Simuku, porphyry-style copper, gold, and molybdenum mineralization was present across an area of about 4.5 kilometers (km) by 2 km. Historical work, and exploration in 2008, including greater than 5,000 meters (m) of drilling, defined a 3,500-m by 650-m area anomalous for copper and molybdenum. Historical trenching led to the determination of supergene enrichment, and primary copper mineralization in the range of 0.1% to 0.5% copper in quartz feldspar porphyry. Intercepts of greater than 1.0% copper were present in narrow intervals. At the Nayam and the Tobarum prospects, intersects were found from the surface down to greater than 300-m depth that included 0.38% to 0.71% copper, 0.05 to 0.11 grams per metric ton (g/t) gold, 26 to 136 g/t molybdenum, and 1.29 to 2.82 g/t silver (Coppermoly Ltd., 2009, p. 1-5).

Harmony Gold announced a new zone of porphyry-style copper and gold mineralization at the Nambonga North prospect, which was an advanced prospect in an area surrounding the prefeasibility Wafi-Golpu project. Mineralization occurred as banded quartz, magnetite, and chalcopyrite vein stockwork developed in both diorite porphyry and the surrounding metasediments. In addition to porphyry copper and gold mineralization, exploration at Nambonga North revealed base-metal and gold mineralization associated with a massive sulfide lens at the contact of the intrusion. The Biamena prospect was an advanced project that the company reported had the potential to deliver a multimillion-troy-ounce deposit similar to that of the Wafi-Golpu project. Definition drilling was to remain a priority into 2009. The company reported total resources in Papua New Guinea of 317,000 kg of gold, 1.8 Mkg of silver, 1.2 Mt of copper, and 15,000 t of molybdenum. The Hidden Valley Mine, which is located in Morobe Province, was designed to process about 4.2 Mt/yr of ore from two open pits—one large open pit on the Hamata ore body and a second, larger open pit on the Hidden Valley and the Kaveroi ore bodies. Annual gold production was projected to peak at 8,500 kg in 2019. The mine was scheduled to be commissioned in mid-2009. By yearend 2008, engineering design was 91% complete, procurement was 87% complete, and the overall project was 57% complete (Harmony Gold Mining Co. Ltd., 2008, p. 13, 46-48, 63).

The Ok Tedi Mine is an open pit mine located on Mt. Fubilan in the Star Mountain region of Papua New Guinea near the border with the Indonesian Province of Papua. In 2008, the Ok Tedi copper and gold mine produced 159,650 t of copper and 16,032 kg of gold compared with 169,184 t and 15,514 kg, respectively, in 2007. The mine began gold production in 1984 and copper production in 1987. The pit covered about 2.6 km^2, from which about 160,000 t of ore and waste rock were mined each day. The mine and processing plant were situated near the upper reaches of the Ok Tedi River. The operation had caused increased sedimentation of the Fly and the Ok Tedi River systems that resulted in overbank flooding and localized acid rock drainage. In 2007, 56 Mt of tailings and overburden rock were discharged into the Ok Tedi River. The expected mine life was projected to 2013 and a long-term mine closure plan was under consideration. In 2008, a mine closure manager was appointed to what would be one of the world's largest and most challenging mine closure projects ever attempted. In 2008, the mine had about 2,000 direct employees (out of 6.3 million people in the country) (Ok Tedi Mining Ltd., 2009).

Marengo Mining Ltd. began a definitive feasibility study of its Yandera porphyry copper and molybdenum project in late 2007. The two-phase study was expected to be completed by June 2009. The Yandera project covers 1,500 km^2 situated along the Bundi Fault Zone and is located near the Provincial capital of Madang. A November 2007 resource estimate included an indicated resource of 163 Mt grading 0.49% copper equivalent and an inferred resource of 497 Mt grading 0.48% copper equivalent (Marengo Mining Ltd., 2009, p. 11).

Nautilus Minerals Inc. of Canada continued exploration of seafloor massive sulfide mineralization for future mining from its deepwater holdings. These deposit types, which form where rising hot hydrothermal fluids mix with cold sea water on the seafloor, have been considered prospective for copper, gold, silver, and zinc because of their similarities with volcanic massive sulfide deposits that have hosted some of the world's significant reserves of precious and base metals. Nautilus had been granted exploration licenses at 74 holdings in the Bismark Sea and the Woodlark Basin, had applied for a mining lease over the Solwara 1 deposit, and had submitted a completed environmental impact statement to the Government to support the mining application. Citing uncertainty in commodity and financial markets related to the global economic downturn, and after suffering net losses in excess of $80 million in 2008, the company postponed the construction of mining system equipment, but intended to proceed with permitting for the Solara 1 project and to continue exploration that would increase its resource base. All supplier agreements were terminated, including the mining support vessel agreement. The company expected that ore production for the Solara 1 project would be delayed at least until December 2010. Nautilus and its Canadian exploration partner Teck Cominco Ltd., had discovered 21 new seafloor massive sulfide deposits in 2007 and 2008, which were reported to have a high-grade base and precious metal materials, especially gold and silver (Nautilus Minerals, Inc., 2009a p. 1; 2009b, p. 10, 46-47).

Xstrata plc of Switzerland completed more than 20,000 m of drilling and a scoping study for the Frieda River copper project in 2008. The company's first resource estimate for the project included 51 Mt for the Nena deposit and 840 Mt at the Horse-Ivaal-Trukai porphyry deposit. The Frieda River project is a major copper and gold porphyry epithermal system within the New Guinea mobile belt. The Frieda River igneous complex, from which the project deposits formed, was defined as a 15-km by 7-km oval area with a central zone of basaltic andesite volcanic rocks and diorite intrusive rocks with diorite plugs along the rim. In 1999, the southeastern quadrant of the complex was reported to have at least seven stockwork porphyry copper and skarn hosted deposits, including the Horse-Ivaal and the Koki deposits. An elongated 13-km by 4-km area of advanced argillic alteration in the center of the complex was found to host the Nena deposit and about 20 high sulfidation-type prospects situated along northwest-trending regional-scale siliceous ridges. The Nena deposit is located 4 km from the nearest major porphyry and was a pod of vein and replacement sulfides in a tectonically controlled multiphase breccia (Morrison, Kary, and Handfield, 1999; Xstrata plc, 2009, p. 61).

Allied Gold completed construction at the Simberi gold project in the Tabar Islands and poured its first gold bar in February 2008. By June, the company had mined about 416,000 t of ore, of which it processed 411,297 t at a grade of 2.95 g/t gold at a recovery rate of 84.3% for 1,028 kg of gold produced. Total estimated gold resources include about 12 Mt at an average grade of 1.29 g/t gold for about 15,500 kg of gold. Ore for the plant was sourced from deposits located at Samat and Sorowar. The processing plant was located on the eastern coast of Simberi Island near Pigiput Bay. The plant used a deep sea placement tailings-management method whereby spent ore or tailings were pumped to a mixing tank on the shore of Pigiput Bay, mixed to a ratio of one part tailings to eight parts seawater, and then discharged by pipeline at a depth of 115 m below sea level so that it would land at a depth of greater than 3 km on the base of a steep submarine slope (Allied Gold Ltd., 2008, p. 3-13; Resource Information Unit, 2009, p. 96).

Barrick Gold's Porgera gold mine produced about 20,000 kg of gold in 2008 compared with about 15,000 kg in 2007. The increase was attributable to increased throughput and grade from the open pit and the fact that production was negatively affected in the third quarter of 2007 by a damaged power station. In the first half of 2008, the company started a mine expansion assessment. The Stage 6 expansion would extend the mine life to 2015. The stockpile of low-grade ore at Porgera was expected to be depleted in 2021 (Barrick Gold Corp., 2009a, p. 3; 2009b, p. 16).

Gold Aura reported that exploration at the Fergusson Island gold project revealed two gold deposits within the project area, including the Wapolu deposit on northwest Fergusson Island, and the Gameta deposit, which is located in the northeast. A prefeasibility study in 2004-05 indicated that a viable gold mine could be established at Gameta with annual gold production capacity of about 55,000 troy ounces (Gold Aura Ltd., 2008, p. 1-6).

Lihir Gold produced about 24,000 kg of gold in 2008 compared with 21,800 kg in 2007 from its Lihir Island operation. The increased production was attributable to a 2007 expansion at the processing plant, including a flotation circuit with additional milling and oxygen capacity, that led to increased throughput. The Lihir Island operation had produced 218,000 kg of gold since 1997. The mine consisted of a single ore body with three open pits—the Minifie, the Lienetz, and the Kapit. Mining at the Minifie pit was completed and mining proceeded to the Lienetz pit, which is a higher grade zone. The Lienetz open pit was projected to be the major source of ore until 2014 when mining would move to the Kapit open pit. The ore at Lihir Island was predominantly refractory sulfide ore that was processed through pressure oxidation (a process that uses high temperature and pressure autoclaves to oxidize the sulfides). About 75% of the operation's power requirements were met by geothermal power; however, additional drilling to identify expanded resources would be required to remedy an inconsistent steam supply. Total measured and indicated resources at yearend were reported to be 384.1 Mt at an average grade of 2.67 g/t gold for greater than 1 Mkg of gold (Lihir Gold Ltd., 2009, p. 12-15).

New Guinea Gold Corp. expected to produce about 100 kilograms per month of gold toward the end of 2008 from the Sinivit gold mine in 2008; however, the company's crushing and leaching capacity was insufficient, and the project was reported to be undercapitalized. The company has been producing gold since the second quarter of 2007. Production in 2008 amounted to 210 kg of gold and 25 kg of silver sourced from the oxide cap of a copper, gold, quartz, silver, and tellurium epithermal vein system. Tellurium was identified in a drill hole that had 1,467 g/t tellurium, 113 g/t silver, 36 g/t gold, and 3.0% copper. The company announced resource estimates for the Imwauna project, including inferred resources of 1.8 Mt grading 12.2 g/t gold and 20 g/t silver for nearly 22,000 kg of gold and greater than 36,000 kg of silver mineralization that was not refractory, so that an open pit operation was likely. The preliminary feasibility study was in process; production of 1,500 to 3,000 kilograms per year was projected by 2011 (Papua New Guinea Gold Corp., 2009, p. 1-6).

Nickel and Cobalt.—Highlands Pacific Ltd.'s Ramu Nickel Cobalt project was under construction in 2008 and was scheduled to be commissioned in late 2009. The project contained an estimated resource of 143 Mt at grades of 1.01% nickel and 0.1% cobalt. The company reported that the project would produce 31,150 metric tons per year (t/yr) of nickel and 3,300 t/yr of cobalt for at least a 20-year mine life (Highlands Pacific Ltd., 2009, p. 3).

Outlook

At the end of 2008, Papua New Guinea was in a relatively more comfortable economic situation than some other small countries with emerging economies, or even some with advanced economies, and its banks were operating at high levels of liquidity. A reform of the financial sector in 2000 that introduced such legislation as the Central Banking Act and the Banks and Financial Institutions Act combined with the commodities boom of the early 2000s led the financial sector on a path of improved performance. Thus, by 2008, the ratio of nonperforming loans to total loans declined to 1.3% in September 2008 from 16.9% in 2000. Papua New Guinea's banking system was somewhat isolated from the international capital markets because of its deposit-based funding, rather than wholesale funding, which accounted for more than 80% of its liabilities, about 50% of which were held in the Papua New Guinea kina; the rest were held in Australian or United States dollars. The Australian holders also relied primarily on domestic funding, which further minimized third-party exposure to the stressed international financial institutions.

The mining industry has numerous projects that are under exploration, moving through the permitting process, or coming into production. With the advent of seafloor metals mining, the country may be recognized as a test case for the approach but also raise environmental issues that have not previously been encountered. Given the country's remote location, small land area, and sometimes severe climate and terrain, combined with a large indigenous population and a fragile ecosystem, concerns over mining and environmental sustainability are likely to be numerous in the years to come as the number of projects increases (International Monetary Fund, 2009, p. 3-7).

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TABLE 1

PAPUA NEW GUINEA: PRODUCTION OF MINERAL COMMODITIES[1]

Commodity[2]		2004	2005	2006	2007	2008[e]
Copper, mine output, Cu content	metric tons	173,370	192,978	194,355	199,400 [r]	187,000 [3]
Gas, natural, marketed	million cubic meters	156	154	155	136 [e]	135
Gold, mine output, Au content	kilograms	73,670	68,483	58,349	57,500 [r]	64,000 [3]
Petroleum, crude	thousand 42-gallon barrels	15,495	17,113	17,886	13,800 [r]	12,400 [3]
Silver, mine output, Ag content	kilograms	55,600	51,125	51,098	51,300 [e]	52,000

[e] Estimated; estimated data are rounded to no more than three significant digits. [r] Revised.

[1] Table includes data available through September 11, 2009.

[2] In addition to the commodities listed, cement, crude construction materials (common clays, sand and gravel, and stone), and refined petroleum products are produced, but available general information is inadequate to make a reliable estimate of output.

[3] Calculated from known values of export volumes in 2007 and 2008 and the percentage of the volume retained for domestic use in 2007.

Sources: World Mineral Production 2002-06. Papua New Guinea Chamber of Mines and Petroleum, Papua New Guinea Mineral Production, 2003-06; Papua New Guinea Oil Production, 2003-06; Papua New Guinea Gas Production, 2003-06. December 2007 Presentation at 2008 Annual General Meeting Executive Director's Report, May 2, 2008.

TABLE 2
PAPUA NEW GUINEA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities[1]	Annual capacity[e]
Cement	thousand metric tons	Papua New Guinea-Halla Cement Pty. Ltd. (Halla Cement Corp., 50%, and Government, 50%)	Lae, Morobe Province	200
Copper	do.	Ok Tedi Mining Ltd., operator (National Papua New Guinea Sustainable Development Program Ltd., 52%; Government, 30%; Inmet Mining Ltd., 18%)	Ok Tedi open cut, Western Province, 20 km northwest of Tabubil and 390 km southwest of Wewak	210
Gold		Lihir Gold Ltd., operator, 100%	Lihir open cut, Lihir Island, New Ireland Province, 700 km northeast of Port Moresby	24
Do.		Highlands Pacific Ltd., 95%	Kainantu underground mine, Eastern Highlands Province, 180 km west of Port Lae	2
Do.		Ok Tedi Mining Ltd. (National Papua New Guinea Sustainable Development Program Ltd., 52%; Government, 30%; Imnet Mining Ltd., 18%)	Ok Tedi open cut, Western Province, 20 km northwest of Tabubil and 390 km southwest of Wewak	16
Do.		Porgera Joint Venture [Placer Dome Inc. (operator), which was a subsidiary of Barrick Gold Corp., 95%, and Mineral Resources Enga, 5%]	Porgera open cut and underground mines, Enga Province, 620 km northwest of Port Moresby	19
Do.		Tolukuma Gold Mine, PNG (wholly owned subsidiary of Emperor Mines Ltd., which was 78.72% owned by DRDGOLD Ltd.)	Tolukuma underground mine and small open pit, Central Province, 100 km north of Port Moresby	2
Do.		New Guinea Gold Corp. (New Guinea Gold Corp., 90%, and Gold Mines of Niugini Holdings, 10%)	Sinivit open pit on Tabar Island Group, about 60 km northwest of Lihir in New Ireland Province	1
Natural gas	thousand cubic meters per day	Exxon Mobil Corp. (operator) (Oil Search Ltd., 21.5%)	Hides Gasfield, Southern Highlands Province. Onshore Papuan Basin, petroleum development license	140
Petroleum				
Crude	thousand 42-gallon barrels per day	Petroleum development license 2: Chevron Niugini Ltd. operator and manager), 19.37%; Oil Search (Kutubu) Ltd., 27.14%; Orogen Minerals Ltd., 25.44%; Exxon Mobil Corp., 14.52%; Petroleum Resources (Kutubu) Ltd., 6.75%; and Merlin Petroleum Co., 6.78% Petroleum development license 5: Exxon Mobil Corp. (operator and manager), 47.5%, and Oil Search Ltd., 52.5%	Central Moran oilfield, Southern Highlands Province (includes Agogo and Iaqufi-Hedinia Fields). Onshore Papuan Basin, petroleum development licenses 2 and 5	20
Do.	do.	Chevron Niugini Ltd. (operator and manager), 19.37%; Oil Search Ltd., 27.14%; Orogen Minerals Ltd., 30.19%; Exxon Mobil Corp., 14.52%; Merlin Petroleum Co., 6.78%; Petroleum Resources Ltd. (Gobe), 2.0%	Gobe Main oilfield, Southern Highlands Province. Onshore Papuan Basin, petroleum development license 4	11
Do.	do.	Chevron Niugini Ltd. (operator and manager), 19.37%; Oil Search Ltd., 27.14%; Orogen Minerals Ltd., 25.44%; Exxon Mobil Corp., 14.52%; Petroleum Resources (Kutubu) Ltd., 6.75%; and Merlin Petroleum Co., 6.78%	Kutubu oilfield, Southern Highlands Province. Onshore Papuan Basin, petroleum development license 2	16
Do.	do.	Santos Ltd. (operator and manager), 15.5%; Southern Highlands Petroleum Ltd., 39.14%; Orogen Minerals Ltd., 20.5%; Oil Search Ltd., 15.50%; Cue PNG Oil Co. Ltd., 5.42%; Petroleum Resources (Gobe) Ltd., 2.0%; and Mountains West Exploration, Inc., 1.94%	SE Gobe oilfield, Gulf and Southern Highlands Provinces. Onshore Papuan Basin, petroleum development licenses 3 and 4	11
Refinery products	do.	InterOil Corp.	Port Moresby	33
Silver	do.	Ok Tedi Mining Ltd. (operator) (National Papua New Guinea Sustainable Development Program Ltd., 52%; Government, 30%; Inmet Mining Ltd., 18%)	Ok Tedi open cut, Western Province, 20 km northwest of Tabulio and 390 km southwest of Wewak	46
Do.	do.	The Porgera Joint Venture (Placer Dome Inc. (operator), which was a subsidiary of Barrick Gold Corp., 75%; Orogen Minerals Ltd., 20%; and Mineral Resources Porgera Pty. Ltd., 5%)	Porgera open cut and underground mines, Enga Province, 620 km northwest of Port Moresby	4

[e] Estimated. Do., do. Ditto.

[1] Abbreviations used for unit of measure in this table included the following: km, kilometer.

THE MINERAL INDUSTRY OF THE PHILIPPINES

By Yolanda Fong-Sam

In 2008, the Philippines produced more than 5% of the total world production of nickel (Kuck, 2010). Other mineral commodities produced in the Philippines included cement, chromium, copper, gold, marine salt, and silver (table 1).

Minerals in the National Economy

In 2008, the mining and quarrying sector (at constant 1985 prices) contributed 1.70% of the Philippine gross domestic product (GDP) compared with 1.73% (revised) in 2007, which was a decrease of 1.7%. The construction sector contributed 4.63% of the GDP in 2008 compared with 4.5% (revised) in 2007, which was an increase of 2.9% (Bangko Sentral ng Pilipinas, 2009).

Government Policies and Programs

The 1995 Philippine Mining Act regulates mineral resources development, requires the Government to maintain an inventory of mineral reserves, and encourages direct investment in mineral exploration and development activities in the Philippines. The Government grants exploration permits to qualified applicants to explore for mineral resources; the exploration permit is valid for a period of 2 years and is renewable for not more than 4 years for exploration of nonmetallic minerals and 6 years for exploration of metallic minerals (Mines and Geosciences Bureau, 2010).

The 1995 Philippine Mining Act allows for three types of mining agreements. The first is a mineral agreement in which the Government grants a domestic contractor (a Filipino individual or corporation) an exclusive right to conduct mining operations in the contracted area. The agreement is valid for 25 years and is renewable for another 25 years. The second type of mining agreement is a Financial or Technical Assistance Agreement (FTAA), which is available to domestic and foreign corporations for a maximum area of 81,000 hectares (ha) onshore or 324,000 hectares offshore; this agreement is valid for a period of 25 years and is renewable for another 25-year period. The third type of agreement is a mineral production-sharing agreement for properties with a maximum area of 16,200 ha; this permit, which is open to domestic and foreign corporations, is valid for a period of 25 years and is renewable for another 25-year period (Mines and Geosciences Bureau, 2010).

Production

In 2008, the Philippines Department of Energy reported a 425% increase in the production of crude petroleum to 965,000 barrels (bbl) from 184,000 bbl in 2007. Mineral production also increased for the following commodities: bentonite (by 24%); liquefied petroleum gas (21%); copper from smelter and refinery (12% and 8.4%, respectively); and coal, (6%). The mineral commodities for which production decreased significantly were zinc (by 78%), silver (54%), chromite (52%), residual fuel oil (25%), gold (8.3%), and nickel (8.2%) (table 1).

Structure of the Mineral Industry

The significant producers of mineral commodities in the Philippines were Lepanto Consolidated Mining Co. (gold and silver); Nickel Asia Corp. (nickel from the Cagdianao and the Taganito projects); Philex Mining Corp. of Canada (copper and gold); and TVI Resources Development Philippine Inc., which was the Philippine affiliate of TVI Pacific Inc. of Canada (gold and silver). The country's major mineral industry facilities are listed in table 2.

Mineral Trade

In 2008, total trade in the Philippines decreased by about 0.15% to $105.824 billion from $105.979 billion in 2007. The country's total exports in 2008 were valued at $49.078 billion compared with $50.466 billion in 2007, which was a decrease of 2.8%. The total value of imports increased by 2.2% in 2008 to $56.746 billion from $55.514 billion in 2007. Exports of cathodes and sections of cathodes of refined copper, and petroleum products were valued at $2.55 billion (or about 5.2% of the country's total export value) compared with $2.4 billion in 2007, which was an increase of more than 6%. Imports of iron and steel and mineral fuels and related materials were valued at $14.01 billion (about 24.7% of the country's total import value) compared with $10.8 billion in 2007, which represented an increase of more than 29% (National Statistics Office of the Philippines, 2009).

In 2008, the Philippines' main trading partner was the United States, which accounted for 14.6% of the country's total trade; exports to and imports from the United States were valued at $8.21 billion and $7.22 billion, respectively. The total trade in 2008 between the Philippines and the United States was valued at $15.43 billion compared with $16.43 billion in 2007, which represented a 6.1% decrease in trade. The second ranked trading partner was Japan, which accounted for 13.5% of total trade; exports to Japan were valued at $7.7 billion and imports from Japan were valued at $6.6 billion. Total trade between the two countries was valued at $14.31 billion in 2008 compared with $14.15 billion in 2007, which was an increase of more than 1%. The country's third and fourth ranked trading partners were China and Singapore, which accounted for 9.2% and 8.1% of the Philippines' total trade, respectively. Exports to China were valued at $5.47 billion and imports from China were valued at $4.25 billion, for a total of $9.72 billion in 2008 compared with $9.75 billion in 2007, or a decrease of more than 0.3%. Exports to Singapore were valued at $2.61 billion and imports from Singapore were valued at $5.95 billion for a total of $8.55 billion in 2008 compared with $9.36 billion in 2007, or a decrease of 8.6% (National Statistics Office of the Philippines, 2009).

Commodity Review

Metals

Chromium.—Chromite production plummeted in 2008 to 15,268 metric tons (t) from the 31,592 t reported in 2007 (table 1). The decrease in production was mainly owing to lower ore grades reported at mine sites. In 2008, chromite production at the Diginat chromite project (which was owned by Krominco Inc. of the Philippines) fell at a rate of 31% to 8,529 t from 12,379 t in 2007. Although total production of chromite decreased in 2008, ore production reported for the Heritage Resources Mining Corp's. Homonhon chromite project increased to 1,700 t from zero production in 2007 (National Statistical Coordination Board, 2008a; Mines and Geosciences Bureau, 2009).

Copper.—Mined copper production in 2008 was 21,235 t of metal content, which represented a decrease of 7.1% compared with production in 2007 of 22,862 t. Copper mine output reported from the Enargite project was 1,507 t compared with zero production in 2007; the Padcal copper project produced 18,792 t (8.6% less than production of 20,568 t in 2007); and the Rapu-Rapu polymetallic project produced 936 t compared with 2,294 t in 2007 (a decrease of 59%). On the other hand, production of smelter and refined copper increased by 12.1% and 8.4%, respectively (table 1). In April 2008, the Philippines Department of Environment and Natural Resources announced that negotiations concerning Rapu-Rapu polymetallic project's new ownership had been completed. Kores (the investment entity of the Government of the Republic of Korea) through its holding company Philco Resources Ltd. was to own 70% of the project and Malaysian Smelting Corp. (MSC) in partnership with LG Group of the Republic of Korea would own the remaining 30%. Philco and MSC acquired the Rapu-Rapu project from former owner Lafayette Mining Ltd. of Australia (Intellasia.net, 2008; Mines and Geosciences Bureau, 2009).

Gold.—Gold production in the Philippines decreased by 8.3% to 35,568 kilograms (kg) in 2008 (table 1). Based on gold purchases by the Bangko Sentral ng Pilipinas (Philippines Central Bank), small-scale mines produced 28,198 kg in 2008 compared with 31,166 kg (revised) in 2007, which was a decrease of 9.5%. The Lepanto Consolidated Mining Co.'s Enargite project reported initial gold production in 2008 of 415 kg. The company's Teresa and Victoria gold projects reported decreases in production of 66% and 57%, respectively. The Teresa project produced 144 kg of gold in 2008 compared with 423 kg in 2007; the Victoria project produced 402 kg of gold compared with 935 kg in 2007 (Mines and Geosciences Bureau, 2009).

Nickel.—In 2008, nickel production decreased to 83,895 t from 91,367 t (revised) in 2007 (table 1). The sharpest decreases in nickel production were reported from the following projects: the SR Metal project (to 5,314 t in 2008 from 20,920 t in 2007), the Cagdianao nickel project (to 4,585 t from 9,459 t), and the Tagana-an nickel project (to 1,600 t from 6,551 t). On the other hand, production soared in the Adlay-Cagdianao-Tandawa nickel project (to 12,409 t in 2008 from 8,163 t in 2007), the Rio Tuba nickel project (to 10,459 t from 6,310 t), the Berong nickel project (to 8,120 t from 4,150 t), and the Sta. Cruz-Candelaria mining project (to 3,760 t from 981 t). In November 2008, Sumitomo Metal Mining Co. announced a delay in the start of the company's Taganito nickel project to await possible decreases in production costs. The company planned to complete a feasibility study on the construction of a 30,000-metric-ton-per-year (t/yr) nickel plant at Taganito. The construction, which would be done in partnership with Taganito Mining Corp. of the Philippines, was proposed to begin in 2009 (Mineweb.com, 2008; Mines and Geosciences Bureau, 2009).

Mineral Fuels

Petroleum.—In 2008, production of crude petroleum increased exponentially by 425% to 965,000 bbl from 184,000 bbl (revised) in 2007. The increase was in part owing to production in the Galoc oilfield during the testing phase and initial production that started in the last quarter of 2008 (National Statistical Coordination Board, 2008b).

In 2008, the Philippines' leading oil refining company, Petron Corp., which operated a 180,000-barrel-per-day (bbl/d) refinery in Limay, Bataan, supplied nearly 40% of the country's total fuel requirements. In April 2008, Petron inaugurated the Philippine's first petrochemical feedstock facility at its Limay property. The petrochemical facility included a petro fluidized catalytic cracking unit (PetroFCC) and a propylene recovery unit (PRU); the PetroFCC was used to convert fuel oil into diesel, gasoline, and liquefied petroleum gas (LPG), and yielded higher levels of propylene, whereas the PRU was used to purify the petrochemical feedstock propylene. The capacity of the PetroFCC was estimated to be more than 6.9 million barrels per year, whereas the PRU had a production capacity of 140,000 t/yr of propylene (Petron Corp., 2008b).

In October 2008, Petron reached an agreement with Galoc Production Co. to purchase the first 300,000 bbl of the Palawan light crude oil from its Galoc field, which is located northwest of Palawan. The crude oil was to be processed at Petron's Limay refinery. The Philippines Department of Energy estimated that the Galoc oilfield could produce between 17,000 bbl/d and 20,000 bbl/d of crude oil, which constitutes about 6% of the country's daily demand (Petron Corp., 2008a).

Outlook

Based on current market conditions and on the 2008 performance of the mineral industry, production of mineral commodities in the Philippines in 2009 will likely be dominated by industrial minerals, such as bentonite, marble, and sand and gravel; and mineral fuels, such as coal, crude petroleum, and petroleum products. Production increases will also be dependent on the performance of the many projects that started reporting production in 2008, such as the polymetallic Enargite project and the Galoc oilfield.

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TABLE 1
PHILIPPINES: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
METALS						
Chromium, chromite, gross weight		42,140	38,081	46,728	31,592	15,268
Cobalt, mine output, Co content		100	300	900	1,000	1,000 [e]
Copper:						
Mine output, Cu content		15,984	16,320	17,161	22,862	21,235
Metal:						
Smelter		120,000	201,300 [r]	239,600 [r]	220,000 [r]	246,700
Refined		174,628	172,000	181,000	160,200	173,600
Gold, mine output, Au content	kilograms	35,464	37,490	36,141	38,792	35,568
Iron and steel, steel, crude	thousand metric tons	550	470	558	718	711
Lead, metal, secondary refined		29,000	30,000	30,000	30,000	30,000
Nickel, mine output, Ni content		16,973	26,636	64,705	91,367 [r]	83,895
Silver, mine output, Ag content	kilograms	9,315	19,150	23,502	27,754	12,694
Zinc, Zn content		--	--	--	7,394 [r]	1,619
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	13,346	15,494	12,033	13,048	13,369
Clays:						
Bentonite		3,560	1,000	1,000	1,148	1,422
Red		8,920	3,530	5,420	6,742	7,181
White		13,310	12,220	7,138	7,224	8,745
Other		6,500	13,400	4,901	4,883	5,601
Feldspar		32,110	11,850	15,176	14,837	15,838
Lime[e]		9,000	9,000	3,313 [3]	3,822 [3]	4,299 [3]
Perlite		5,510	4,410	4,352	4,515	4,593
Phosphate rock		2,380	2,180	1,963	1,961	2,271
Pyrite and pyrrhotite, including cuprous, gross weight[e]		300,000	300,000	300,000	300,000	300,000
Salt, marine		427,620	420,950	418,210	437,689	510,059
Sand and gravel:						
Silica sand	thousand metric tons	237	224	179	221	270
Other[4]	thousand cubic meters	36,133	36,792	38,455	40,076	46,659

See footnotes at end of table.

TABLE 1—Continued

PHILIPPINES: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
INDUSTRIAL MINERALS—Continued						
Stone:						
Dolomite		1,408,870	874,730	1,083,269	1,092,748	1,150,035
Limestone[5]	thousand metric tons	20,830	21,112	21,888	26,419	31,528
Marble, dimension, unfinished	cubic meters	4,740	5,120	3,964	4,791	5,410
Volcanic cinder[6]	do.	8,470	8,660	6,378	6,177	6,519
Tuff		19,250	17,850	17,590	16,490	17,570
Quartz[e]		50,000	50,000	50,000	50,000	50,000
Crushed, broken, other[e, 7]	thousand cubic meters	2,500	2,500	2,735 [3]	2,810 [3]	3,077 [3]
Sulfur, all forms[e]		180,000	180,000	180,000	180,000	180,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, all grades	thousand metric tons	2,727	3,165	2,529	3,401 [r]	3,610
Petroleum:						
Crude	thousand 42-gallon barrels	139	208	181	184 [r]	965
Refinery products:[e]						
Liquefied petroleum gas	do.	30,600 [3]	31,000	31,000	2,951 [r, 3]	3,556 [3]
Gasoline	do.	127,600 [3]	128,000	128,000	12,491 [r, 3]	12,920 [3]
Jet fuel	do.	45,800 [3]	46,000	46,000	46,000	46,000
Kerosene	do.	17,700 [3]	18,000	18,000	7,277 [r, 3]	6,596 [3]
Distillate fuel oil	do.	170,000	170,000	170,000	170,000	170,000
Residual fuel oil	do.	234,200 [3]	234,000	234,000	21,226 [r, 3]	15,975 [3]
Refinery fuel and losses	do.	230,000	230,000	230,000	230,000	230,000
Other	do.	225,000	225,000	225,000	1,725 [r, 3]	1,950
Total	do.	1,080,000 [r]	1,080,000 [r]	1,080,000 [r]	492,000 [r]	487,000

[e] Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r] Revised. do. Ditto. -- Zero.

[1] Table includes data available through February 25, 2010.

[2] In addition to the commodities listed, the Philippines produces platinum-group metals as byproducts of other metal production, but available information is inadequate to make estimates of output.

[3] Reported figure.

[4] Includes "pebbles" and "soil" not further described.

[5] Include limestone for agriculture, cement manufacturing, industrial, and other.

[6] Reported as "Black cinder" for years 2006-2008 by the Philippines Mines and Geosciences Bureau.

[7] Includes materials described as rock, crushed or broken/blasted; stones, cobbles, and boulders; pebbles; rock aggregates; and broken adobe.

TABLE 2
PHILIPPINES: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Fortune Cement Corp.	Bulacan plant at Norzagaray, Bulacan Province; Batangas plant at Taysan, Batangas Province	2,100,000.
Do.		Holcim Philippines, Inc.	Bulacan plant at Norzagaray, Bulacan Province; Davao plant at Barrio Ilang, Davao City; La Union plant at Bacnotan, La Union Province; Lugait plant at Lugait, Misamis Oriental Province	7,200,000.
Do.		Solid Cement Corp., APO Cement Corp., and Rizal Cement Corp.	Cement plants at three locations—Naga, Cebu Province (APO Cement Corp.); Antipolo City, Rizal Province (Solid Cement Corp.); Binangonan, Rizal Province (Rizal Cement Corp.)	4,300,000.
Chromite		Consolidated Mines Inc. (owner) and Benguet Corp. (operator)	Masinloc chromite mine (Coto chromite deposit) located in Coto 27 kilometers east of the Port of Mansiloc in Zambales Province	5,000.
Do.		Krominco Inc.	Dinagat chromite project—Redondo Mine (Mt. Redondo deposit) located in the Municipality of Loreto, Dinagat Island	26,000.
Do.		Heritage Resources Mining Corp.	Homonhon chromite project	17,000.
Copper		Lepanto Consolidated Mining Co.	Victoria and Teresa Mines located in Mankayan, Benguet Province	200.
Do.		Philex Mining Corp. (through its subsidiary Philex Gold Inc.), 81%	Padcal copper project located in Tuba, Benguet Province, Island of Luzon	21,000.
Do.		Glencore International AG	Philippine Associated Smelting and Refining Corp. (PASAR), located in Isabel, Leyte Province	250,000 smelter; 173,000 refinery.
Do.		Lafayette Mining Ltd., 75%, and LG International and Korean Resources Corp., 25%	Rapu-Rapu Mine under the Rapu-Rapu polymetallic project, located in Albay Province	36,000.
Gold	kilograms	Lepanto Consolidated Mining Co.	Victoria and Teresa Mines located in Mankayan, Benguet Province	2,000.
Do.	do.	Philex Mining Corp. (through its subsidiary Philex Gold Inc.), 81%	Padcal Mine (Sto. Tomas II deposit) located in Tuba, Benguet Province, Island of Luzon	5,000.
Do.	do.	TVI Resources Development Philippine Inc., 100%	Canatuan project, located east of Siocon, Province of Zamboanga del Norte, Mindanao Island	500.
Do.	do.	Lafayette Mining Ltd., 75%, and LG International and Korean Resources Corp., 25%	Rapu-Rapu Mine under the Rapu-Rapu polymetallic project, located in Albay Province	1,500.
Do.	do.	Philippine Mining Development Corp.	Diwalwal Direct State Development Project at Mount Diwalwal in Davao del Norte Province	100.
Do.	do.	APEX Mining Company Inc.	APEX Maco operation	100.
Nickel		Coral Bay Nickel Corp. (Sumitomo Metal Mining Co. Ltd., 54%; Mitsui & Co. Ltd. 18%; Rio Tuba Nickel Mining Corp., 10%; Nickel Asia Corp., 6%)	Coral Bay nickel high pressure acid leach (HPAL) plant located on Palawan Island in southwest Philippines	10,000.[1]
Do.		Nickel Asia Corp., 100%	Cagdianao nickel project located near Barangay Valencia on Dinagat Island	10,000.

See footnotes at end of table.

TABLE 2—Continued
PHILIPPINES: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Nickel—Continued		Hinatuan Mining Corp.	South Dinagat project located on Nonoc Island	4,000.
Do.		do.	Tagana-an nickel project located on Hinatuan Island	30,000.
Do.		Nickel Asia Corp., 65%, and Pacific Metals Co. Ltd. and Sojitz Philippines, 35%	Claver nickel project (Taganito) located in Surigao del Norte Province, Mindanao Island	12,000.
Do.		Nickel Asia Corp., 60%, and Pacific Metals Co. Ltd. and Sojitz Philippines, 40%	Rio Tuba nickel project, located in Barrio Rio Tuba, Municipality of Bataraza in Palawan Province.	5,000.
Do.		Toledo Mining Corporation Plc., 56.1%	Berong nickel project located on Palawan Island	10,000.
Do.		CRAU Mineral Resources Corp.	Sta. Cruz-Candelaria Nickel project located in Zambales Province	1,000.
Do.		CTP Construction & Mining Corp.	Adlay-Cagdianao-Tandawa (ACT) nickel project, located in Barangay Adlay, Municipality of Carrascal, Province of Surigao del Sur	10,000.
Do.		SR Metals, Inc.	SR Nickel project, Tubay Mine, located in Tubay, Agusan del Norte Province	25,000.
Silver	kilograms	Lepanto Consolidated Mining Co.	Victoria and Teresa Mines located in Mankayan, Benguet Province	4,000.
Do.	do.	TVI Resources Development Philippine Inc., 100%	Canatuan project, located east of Siocon, Province of Zamboanga del Norte, Mindanao Island	17,000.
Do.	do.	Lafayette Mining Ltd., 75%, and LG International and Korean Resources Corp., 25%	Rapu-Rapu Mine under the Rapu-Rapu polymetallic project, located in Albay Province	18,000.
Do.	do.	Philex Mining Corp. (through its subsidiary Philex Gold Inc.), 81%	Padcal Mine (Sto. Tomas II deposit) located in Tuba, Benguet Province, Island of Luzon	5,000.
Zinc		Lafayette Mining Ltd., 75%, and LG International and Korean Resources Corp., 25%	Rapu-Rapu Mine under the Rapu-Rapu polymetallic project, located in Albay Province	8,000.

Do., do. Ditto.

[1] Proposed increase to 20,000 metric tons by 2009.

THE MINERAL INDUSTRY OF SRI LANKA

By Chin S. Kuo

Sri Lanka is endowed with a variety of industrial minerals, such as ball clay, kaolin, and other clays; calcite; dolomite; feldspar; gemstones; graphite; limestone; mica; mineral sands; phosphate rock; quartz; and silica sand. Mining and quarrying of industrial minerals were the main activities of its mineral industry. The country produced no metals or oil and imported more than $2 billion per year of oil. The Government was seeking tenders for oil exploration, and the first foreign company was awarded an exploration license in 2008.

In 2008, the Government reduced fuel subsidies and let gasoline prices rise by 41%. The country's richer households received a disproportionate share of the benefits from price caps, and the bottom 40% received 15% to 25% of subsidies. To reduce the country's dependence on imported petroleum products needed for domestic use, the Government planned to expand its oil refining capacity.

Production

In 2008, Sri Lanka's output level of industrial minerals was about the same as that of 2007. Production of cement, gemstones, and graphite increased slightly, and the output of scrap mica increased by 12%. The country produced 14% less feldspar than in 2007 and 30% less than in the peak year of 2006. Graphite was mined by underground methods and was destined for export (table 1).

Structure of the Mineral Industry

The country's mineral industry is governed by the Mines and Minerals Act No. 33 of 1992 and the Mining (Licensing) Regulation No. 1 of 1993. The Geological Survey and Mines Bureau is the Government agency responsible for the development of mineral resources in Sri Lanka. Production of graphite, mineral sands, phosphate rock, and salt was controlled by state-owned companies; however, a German company owned a large stake in state-owned Bogala Graphite Lanka Ltd. Refining of crude oil was performed by Ceylon Petroleum Corp. under the Ministry of Petroleum and Petroleum Resources Development. Manufacturing of cement was mostly done by domestic private companies and foreign subsidiaries (table 2).

Commodity Review

Industrial Minerals

Graphite.—Bogala Graphite Lanka, which was 87% owned by Graphitwerke Kropfmuhl AG of Germany, produced 29 grades of graphite powders for export to markets in Europe and the United States. A new processing plant was relocated to Sri Lanka from the United Kingdom and commenced operations. Before that, Bogala Graphite Lanka exported raw graphite to be processed at Branwell Graphite Ltd. of the United Kingdom, which was 100% owned by Graphitwerke. RS Products (Pvt) Ltd. of Sri Lanka was granted an exploration license by the Geological Survey and Mines Bureau. The license applied to three selected sites and referred to a 7-square-kilometer (km^2) grid. Early finds of vein graphite of 99.7% carbon purity were reported. Plans were in place to mine these deposits at Matale, and the first shipment was expected in May 2008 (Industrial Minerals, 2008).

Phosphate Rock.—Lanka Phosphate Ltd. planned to produce 45,000 metric tons per year (t/yr) of single superphosphate (SSP) for farmers to cultivate short-term crops, such as rice and vegetables. SSP could be used as a substitute for triple superphosphate, of which Sri Lanka's imported 40,000 t/yr (its major fertilizer import). The company produced Eppawala rock phosphate and high-grade Eppawala rock phosphate, which had lower solubility and slightly higher acidity than the regular grade of rock phosphate. The apatite phosphate rock deposit is located at Eppawala in the Anuradhapura District of North Central Province. The deposit was estimated to contain 60 million metric tons of phosphate rock (Movement for National Land and Agricultural Reform, 2007).

Mineral Fuels

Petroleum.—Saudi Arabia agreed to train Sri Lankans in the field of oil exploration, investment, and refining, and to help define the island's oil resources. Sri Lanka conducted seismic surveys in 2002 and 2005, which indicated that a 35,000-km^2 area in the Mannar Basin was prospective for oil. Seismic data indicated that an estimated 1 billion barrels of oil lie under the basin. Three plots in the basin were allocated for exploration, and exploration rights were awarded to companies from China and India. Six plots would be offered for tenders in 2008. Sri Lanka planned to increase its oil refining capacity to 100,000 barrels per day (bbl/d) from 50,000 bbl/d with Saudi expertise. The country was seeking to build an oil cracker at a cost of $400 million to convert crude oil into diesel and gasoline and requested the assistance of the Organization of the Petroleum Exporting Countries Fund to help construct the plant. Sri Lanka bought 10% of its oil requirements from Saudi Arabia and 70% from Iran. The country planned to increase its oil imports from Saudi Arabia to 30% in the near future (Alexander's Gas & Oil Connections, 2008b).

In the application for exploration permits, the applicants had to pay signature bonds and production bonds to the Government, as well as a 10% loyalty fee during exploration. The permits would be for a period of 8 years and consist of three phases. If additional exploration is needed, a 2-year extension could be granted. Cairn Energy plc of the United Kingdom was awarded an exploration license in the SL 2007–01–001 Block, which covered 3,000 km^2 with water depths ranging from 220 to 1,800 meters (Rigzone.com, 2007).

In 2008, Sri Lanka started the construction of an oil refinery expansion project, which would increase the country's refining capacity to 100,000 bbl/d and reduce imports of petroleum products. Iran provided assistance in the amount of $1.5 billion for the country's infrastructure development projects. In addition to refinery expansion, a multipurpose hydropower project would add 100 megawatts of electricity generating capacity (Alexander's Gas & Oil Connections, 2008a).

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TABLE 1

SRI LANKA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
Cement, hydraulic	thousand metric tons	1,400	1,500	1,600	1,700	1,800
Clays:						
Ball clay		34,000	36,000	61,966 [r, 4]	43,004 [r, 4]	43,000
Kaolin		9,200	9,400	10,914 [r, 4]	11,178 [r, 4]	11,000
Brick and tile clay		8,000	8,000	8,000	8,000	8,000
Clays for cement manufacture		900	950	950	950	950
Feldspar, crude and ground		33,000	34,000	56,864 [r, 4]	46,583 [r, 4]	40,000
Gemstones, precious and semiprecious, other than diamond, value	thousands	$99,000	$101,000	$103,000	$105,000	$108,000
Cat's eye	carats	46,000	47,000	48,000	49,000	50,000
Ruby	do.	15,000	17,000	19,000	21,000	23,000
Sapphire	do.	780,000	785,000	790,000	780,000	770,000
Other	do.	1,900,000	2,000,000	2,100,000	2,200,000	2,300,000
Graphite, all grades		3,400	3,000	5,756 [r, 4]	9,593 [r, 4]	10,000
Iron and steel, metal, semimanufactures		50,000	50,000	50,000	50,000	50,000
Mica, scrap		1,700	1,700	2,600 [r, 4]	3,224 [r, 4]	3,600
Petroleum refinery products:						
Gasoline	thousand 42-gallon barrels	2,100	2,200	2,200	2,300	2,300
Jet fuel	do.	650	650	700	700	750
Kerosene	do.	1,500	1,500	1,500	1,500	1,500
Distillate fuel oil	do.	5,100	5,200	5,300	5,400	5,500
Residual fuel oil	do.	5,100	5,100	5,000	5,000	4,800
Refinery fuel and losses	do.	720	720	730	730	740
Other	do.	2,100	2,200	2,300	2,400	2,500
Total	do.	17,300	17,600	17,700	18,000	18,100
Phosphate rock, gross weight		42,000	43,000	42,159 [r, 4]	40,128 [r, 4]	40,000
Salt		79,000	80,000	87,560 [r, 4]	70,209 [r, 4]	70,000
Stone:						
Limestone	thousand metric tons	1,000	1,010	1,095 [r, 4]	1,095 [r, 4]	1,100
Quartzite		20,000	22,000	25,539 [r, 4]	35,066 [r, 4]	35,000

[r] Revised. do. Ditto.

[1] Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2] Table includes data available through July 15, 2009.

[3] In addition to the commodities listed, crude construction materials, such as sand and gravel, sulfur, and varieties of stone, presumably are produced, but available information is inadequate to make reliable estimates of output.

[4] Reported figure.

TABLE 2
SRI LANKA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Cement		Holcim (Lanka) Ltd.	Puttalam	1,000
Do.		Sri Lanka Cement Corp.	Kankesanturai	1,000
Do.		do.	Puttalam	400
Do.		Tokyo Cement Co. (Lanka) Ltd.	Trincomalee	300
Clay, ball		Lanka Ceramic Ltd.	Dediyawala	NA
Graphite		Kahatagaha Graphite Lanka Ltd. (Ministry of Industrial Development)	Kahatagaha Mine	4
Do.		Bogala Graphite Lanka Ltd. (Graphit Kropfmul A, 87%)	Bogala Mine	7
Petroleum, refined	42-gallon barrels per day	Ceylon Petroleum Corp. (Ministry of Petroleum and Petroleum Resources Development)	Sapugaskanda	51,000
Phosphate rock		Lanka Phosphate Ltd. (Ministry of Industrial Development)	Eppawala	40
Titanium, ilmenite sands		Lanka Mineral Sands Corp. (Ministry of Industrial Development)	Pulmoddai	180

[e] Estimated. Do., do. Ditto. NA Not available.

The Ministry Industry of Taiwan

By Pui-Kwan Tse

Taiwan's economy was oriented towards exports, and its growth prospects depended on the world economy. In 2008, owing to the global financial crisis, external demand for manufactured products decreased, especially during the second half of the year. After growing by an average of 5.4% during the first two quarters of the year, the gross domestic product (GDP) contracted by 1.0% in the third quarter and then by 8.4% in the fourth quarter. For the year, the GDP growth rate was 0.12%, which was the lowest since 2001 when the global demand for information technology decreased. In 2008, exports of goods were valued at $255 billion, which was a 3.6% increase compared with the value in 2007. The growth was led by chemical, iron and steel, and nonferrous metal products exports. Imports also increased to $240 billion in 2008, or by 9.7%, compared with an increase of 8.1% in 2007. Coal, oil, and raw materials were the major imported commodities. China was Taiwan's leading trade partner followed by Japan, the United States, and Hong Kong (Directorate General of Budget, Accounting, and Statistics, 2009, p. 3, 39-41).

The Legislative Yuan planned to amend the income tax law. Under the current law, individual investors were required to incorporate their gains from investment in equity into personal consolidated taxable income, but other financial investment gains were taxed at different rates. The ceiling for the personal consolidated income tax rate was 40%. The Ministry of Finance recommended revision of the tax on gains from investment in bonds, repurchase agreements, and short-term bills to a uniform rate of 10%. The rate of the corporate investment tax on financial activities was expected to remain unchanged at 25%. The Legislative Yuan also planned to ratify an energy bill and an energy management bill (China Post, The, 2009a).

Minerals in the National Economy

Major minerals identified on the island included clay, coal, copper, dolomite, feldspar, gold, gypsum, natural gas, petroleum, serpentine, and talc. After several decades of mining, nearly all the recoverable coal, metallic minerals, and talc had been depleted. The output of the mining industry, which had a very small effect on the island's economy, was less than 1% of total industrial production (Directorate General of Budget, Accounting, and Statistics, 2009, p. 22).

Production

The major mining activities in Taiwan were the production of dolomite, limestone, marble, natural gas, and petroleum. Natural gas and petroleum were produced on the western part of the island, and limestone and marble were mined on the eastern part of the island. Employment in mining and quarrying had steadily decreased since the early 1990s to about 5,000 in 2008. The production value of the major mineral commodities was $390 million, of which $191 million was from fuels. Besides natural gas, marble was the island's most valuable mineral commodity. Because Taiwan had no domestic primary aluminum, copper, lead, or zinc smelting capacity, downstream metal producers relied on imports of ingots and scrap to produce products from these metals. Owing to high labor costs, environmental problems, and weak domestic demand, the output of these industries had gradually decreased during the past several years, and companies had moved their manufacturing facilities to mainland China and Southeast Asian countries (Bureau of Mines, 2009; Directorate General of Budget, Accounting, and Statistics, 2009, p. 13).

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Commodity Review

Metals

Iron and Steel.—Taiwan was the 12th ranked crude steel producer in the world and the 5th ranked producer in Asia behind China, Japan, India, and the Republic of Korea. Owing to the increased prices of coking coal, iron and steel scrap, and iron ore and the decline in the prices of steel products during the second half of the year, most of Taiwan's iron and steel companies faced financial losses in 2008. Because of the shortage in supply and the high prices of steel billet, scrap, and rebar in 2007, the Taiwan authorities banned exports of rebar from Taiwan in 2007, although they continued to allow the export of steel scrap. The demand for rebar from the construction sector was weak, however, and rebar was widely available on the island; as a result, steel producers urged the Taiwan authorities to allow them to export rebar freely. Owing to weak demand for rebar, China Steel Corp. (CSC) shut down one of its blast furnaces for care and maintenance in late 2008 (South East Asia Iron and Steel Institute Newsletter, 2008).

CSC was the leading steel producer and the only pig iron producer in Taiwan. In 2008, CSC decided to acquire 100% of the shares of Dragon Steel Corp. Dragon Steel (formerly Kuei Yu Steel Corp.) had an output capacity of 600,000 metric tons per year (t/yr) of H-beam steel and 300,000 t/yr of steel billet, which were cast in a 150-metric-ton (t) twin-shell-type direct current electric arc furnace (EAF). The EAF had an output capacity of 1 million metric tons per year (Mt/yr) of crude steel. The recovery efficiency of products was 91%. With the acquisition of Dragon Steel, CSC would be able to reduce production costs by consolidating material procurement, production, and distribution channels. Dragon Steel installed a "Primus" recycling plant to recover and process iron and zinc dust from the existing furnace. The recycling plant had a capacity of 100,000 t/yr (dry base) of fine material. The multiple-hearth furnace in the recycling plant could be operated with different feed mixes, ranging from 100% EAF dust to a high proportion of blast furnace residues. CSC planned to construct two blast furnaces at the Dragon Steel site, each of which would be able to produce 2.5 Mt/yr of pig iron. The first blast furnace was scheduled to begin production in December 2009 (South East Asia Iron and Steel Institute Newsletter, 2009).

Taiwan's leading petrochemical producer, Formosa Plastics Group (FPG), had planned to build a 7.5-Mt/yr steel plant at Yunlin Offshore Industrial Zone in Yunlin County in 2004. A feasibility study for the construction of an integrated iron and steel plant was submitted to the Taiwan authorities for approval. In 2006, the Environmental Protection Agency ruled that the environmental-impact report submitted by FPG was inadequate because the report did not specify the source of water to be used nor the amount of carbon dioxide and organic compound emissions; therefore, FPG would be required to conduct more studies on these issues. Facing difficulties on the island, FPG decided to turn its attention to the construction of steel plants in Vietnam. FPG signed a land rental contract with the Vietnamese Government and planned to invest $8 billion to build an 8-Mt/yr-capacity iron and steel plant at Vung Ang in Ha Tinh Province, Vietnam. The plant would be built in stages. For the first stage, construction of a 4-Mt/yr-capacity iron and steel plant would start in 2009 and was expected to be completed in 50 months (United Daily News, 2008).

Yieh United Group and CSC discussed a sale of shares of the Tang Eng Stainless Steel Plant that were held by CSC. Yieh United Group's subsidiary Yieh United Steel Co. was the leading stainless steel producer in Taiwan, followed by Tang Eng. The Taiwan authorities held the largest shares of both CSC and Tang Eng. During the year, Yieh United Group acquired a 38% share of Tang Eng at the stock exchange market. If Yieh United Group were to acquire CSC's shares of Tank Eng, Yieh United Group would become the largest shareholder of Tang Eng and, as a consequence, would account for more than 60% of the stainless steel output capacity in Taiwan. The acquisition required approval of the Fair Market Committee (United Daily News, 2009).

Industrial Minerals

Cement.—China resumed sand and gravel exports to Taiwan; however, the global financial crisis affected the construction sector on the island. The demand for sand and gravel decreased because much of the island's construction work was postponed in 2008. The delay of construction projects also led to the decrease in cement production. Owing to a lack of limestone resources and a limited market on the island, Taiwan cement producers had gradually moved their production base to China in the late 1990s and expanded their cement output capacities there. Taiwan's leading cement producer [Taiwan Cement Corp. (TCC)] was positioned to take advantage of the market in southern China and to be a high-end cement producer there. TCC's investment strategy in China was to make direct investments and to form joint ventures with local cement producers. TCC planned to invest $800 million to double its cement production capacity in China by 2012. The total output capacity of TCC's cement plants in China was expected to increase to 52 Mt/yr in 2010 from 26 Mt/yr in 2008. The company planned to build new plants in each of the Provinces of Fujian, Guangdong, and Guangxi, and each plant would have two kilns. Another Taiwanese cement producer, Asia Cement Corp., also planned to expand its cement production capacity in China by 2 Mt to 11 Mt/yr in 2010. Taiwan's other cement producers also planned to build cement plants in Vietnam (China Post, The, 2009b).

Mineral Fuels

Coal.—Taiwan had no domestic coal production and depended on imported coal to meet its demand for coal. Taiwan Power Co. was the leading coal consumer followed by the cement and iron and steel sectors. In 2008, Taiwan imported 63.8 Mt of coal; of that amount, 53.1 Mt was for power generation and 4.8 Mt was for coking. Steam coal was mainly from, in decreasing order of supply, Australia, Indonesia, and China, and coking coal was from Australia and Canada. The island consumed 62.8 Mt of coal in 2008 (Bureau of Energy, 2009a).

Natural Gas and Petroleum.—With its limited mineral fuel resources, Taiwan produced only about 1.9% of its natural gas and petroleum requirements and relied on imports—mainly through long-term contracts with Indonesia, Malaysia, and Qatar—to fill the gap. Liquefied natural gas (LNG) imports increased by about 8% per year during the past decade. State-owned Chinese Petroleum Corp. (CPC) was the sole LNG importing company. CPC's Taichung LNG receiving terminal was completed in 2007. Domestic natural gas supply was expected to be depleted in 2012. Owing to an increase in domestic demand, Indonesia's LNG exports to Taiwan were expected to be reduced by 50% after the current contract expires in 2009. CPC continued discussions with Woodside Co. of Australia to supply between 2 million and 3 million metric tons per year of LNG for 20 years. Taiwan's LNG consumption for power generation was expected to continue to increase to a projected 20 Mt in 2015 from 9.49 Mt in 2008. In 2008, Taiwan imported a total of 9.0 Mt of LNG from Indonesia, Malaysia and Qatar, which accounted for 73% of total imports (Bureau of Energy, 2009b, p. 27-28).

Outlook

Taiwan's economic growth is heavily dependent on external trade. The slowdown in the economy of the United States and other developed countries in the West is expected to decrease demand for its exports. Economic growth in Taiwan is expected to recover slowly during the next 2 years. The service sector accounts for more than 70% of the GDP and, given the island's limited mineral resources, the mining sector is expected to have only a minimal effect on the island's economy in the future. The growth of manufacturing is likely to be led by the computer, electronics components, and telecommunication products sectors. The island relies on imports of raw materials to support its iron and steel and nonferrous metals sectors. The rising prices of these raw materials could affect producers' profit margins, and tightened environmental regulations may force nonferrous metal and steel producers to relocate their production facilities to mineral-rich countries with lower labor costs. The island has been gradually transforming from a labor-intensive manufacturing sector to a knowledge-intensive service sector. The Taiwan authorities continue their effort to promote the island as a green island and to ease restrictions on economic ties with China, primarily in the areas of investment, tourism, trade, and transportation. Such changes would likely stimulate growth in the service sector.

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TABLE 1

TAIWAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
METALS						
Iron and steel:						
Pig iron	thousand metric tons	10,938	9,854	10,500	10,550	9,800
Steel, crude	do.	19,604	18,567	19,203	20,883	19,222
Nickel, refined[e]		11,000	11,000	11,000	11,000	11,000
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	19,050	19,891	19,294	18,957	17,330
Feldspar		900	--	--	--	--
Fire clay		3,686	330	125	1,134	745
Lime		493,733	443,879	440,000 [e]	450,000 [e]	450,000 [e]
Mica		2,973	8,608	4,841	3,387	3,179
Nitrogen, liquid		650,359	794,933	800,000 [e]	800,000 [e]	800,000 [e]
Sodium compounds:[e]						
Caustic soda		570,000	570,000	570,000	570,000	570,000
Soda ash		140,000	140,000	140,000	140,000	140,000
Stone:						
Dolomite	thousand metric tons	115	174	61	94	104
Limestone	do.	213	252	351	210	227
Marble	do.	22,970	24,070	25,493	26,452	25,811
Serpentine	do.	229	408	304	280	264
Sulfur		222,670	267,790	245,789	249,156	211,869
Talc		410	--	--	--	--
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	796	548	463	417	357
Marketed[e]	do.	720	490	410	380	310
Petroleum:						
Crude	thousand 42-gallon barrels	280	203	148	112	101
Refinery products	do.	405,400 [r]	409,700 [r]	421,100 [r]	446,800 [r]	420,500

[e] Estimated; estimated data are rounded to no more than three significant digits. [r] Revised. do. Ditto. -- Zero.

[1] Table includes data available through June 20, 2009.

TABLE 2
TAIWAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilitites	Annual capacity[e]
Cement		Asia Cement Corp.	Hsinchu	1,800
Do.		do.	Hualien	4,020
Do.		Chia Hsin Cement Corp.	Kaohsiung	1,860
Do.		Chien Tai Cement Co. Ltd.	do.	1,720
Do.		Lucky Cement Corp.	Tungao	2,000
Do.		Southeast Cement Corp.	Kaohsiung	1,090
Do.		do.	Chutung	1,400
Do.		Taiwan Cement Corp.	Hualien City	1,600
Do.		do.	Hualian County	5,600
Do.		do.	Suao	3,400
Do.		Universal Cement Corp.	Kaohsiung	1,550
Marble		Taiwan Marble Co., Ltd.	Panchiao	15
Nickel		Taiwan Nickel Refinery	Kaohsiung	14
Petroleum:				
Crude	thousand 42-gallon barrels per year	Chinese Petroleum Corp.	Chuhuangkeng and Tungtzuchiao	850
Refinery products	do.	do.	Kaohsiung	570
Do.	do.	do.	Taoyuan	200
Do.	do.	Formosa Plastics Group	Yunlin	450
Steel		An Feng Steel Co. Ltd.	Kaohsiung Hsien	2,000
Do.		China Steel Corp.	Kaohsiung	13,000
Do.		Dragon Steel Corp.	Taichung Hsien	900
Do.		Tang Eng Stainless Steel Plant	Kaohsiung	300
Do.		Yieh Hsing Enterprise Co. Ltd.	Kaohsiung Hsien	450
Do.		Yieh Phui Enterprise Co. Ltd.	do.	1,300
Do.		Yieh United Steel Co.	do.	1,000
Do.		Feng Hsin Iron and Steel Co. Ltd.	Taichung Hsien	1,200
Sulfur		China Petrochemical Development Corp.	Taipei	280

[e] Estimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto.

THE MINERAL INDUSTRY OF THAILAND

By Lin Shi

In 2008, Thailand was one of the world's leading producers of cement, feldspar, gypsum, and tin. The country's mineral production encompassed metals, industrial minerals, and mineral fuels (table 1; Carlin, 2009; Crangle, 2009; Potter, 2009; van Oss, 2009).

Minerals in the National Economy

Thailand's gross domestic product (GDP) in 2008 was valued at $274 billion, and the annual GDP growth rate was 2.6%. The growth rate of the mining sector's portion of the GDP increased by 0.6% compared with that of 2007, and that of the manufacturing sector increased by 3.9%. Thailand's economy was export dependent, and the export of goods and services accounted for more than 70% of the GDP in 2008. The global financial crisis and persistent political uncertainty weakened Thailand's economic growth by reducing domestic and international demand for its goods and services, including tourism. The country's economic growth slowed and was negative in the fourth quarter of 2008 (Bank of Thailand, 2009; U.S. Department of State, 2009).

Government Policies and Programs

The principal law governing mineral exploration and mining in Thailand is the Minerals Act (1967), which was last amended in 1991 by Minerals Act No 4. The Mineral Act governs onshore and offshore exploration, mineral production, mineral trading, ore dressing, and the transport and export of minerals other than petroleum. The Mineral Royalty Rates Act (1966) prescribes the royalty rates to be assessed for different kinds of minerals. The Department of Primary Industry and Mines (DPIM), which is under the jurisdiction of the Ministry of Mines, is empowered to administer the Minerals Act and to issue ministerial regulations. DPIM also provides technical assistance in exploration, mining, mineral processing, and metallurgical activities. In Thailand, minerals belong to the state. No one can explore for minerals or undertake mining unless a prospecting license or mining lease is first obtained from the Government. The Government has a policy of promoting private-sector development of the mineral industry (Chandler & Thong-ek Law Office Ltd., 2001; Chandler and others, 2009, p. 1)

Production

In 2008, Thailand's mineral sector had both significant decreases and large increases in production. The country, for example, produced no primary refined copper metal and only 438 metric tons (t) of secondary copper metal, which was a decrease of 97% from the 12,714 t of copper produced in 2007. Zinc ore production decreased by 33% to 118,739 t from 176,042 t in 2007, and zinc content of ore production decreased by 46% to 17,811 t from 32,921 t in 2007. Production of iron ore and Fe content (pig iron and semimanufactured products) each increased by about 10% to 1,709,750 t and 855,000 t, respectively; manganese output increased by more than 10 times to 52,700 t from 4,550 t in 2007, and tungsten output increased by 52% to 778 t from 512 t in 2007 (table 1).

Among the industrial minerals, production of sand, silica, and glass decreased by 41%; that of marble, dimension stone, and fragment, by 22%; and pyrophyllite, by 74%. Production of ball clay increased by 166% to 1,499,993 t from 563,353 t in 2007; calcite and dolomite increased by 22% each; crude petroleum oil increased by 9% to 53,151 barrels (bbl) from 48,745 bbl in 2007; and natural gas condensate increased by 9% to 31,340 bbl from 28,778 bbl in 2007 (table 1).

Mineral Trade

Thailand's annual exports increased by 16.8% in 2008, and the manufacturing sector was the leading contributor to this growth. Crude oil, iron and steel, and mineral fuels and related materials were among Thailand's principal imports. The United States was Thailand's leading export market (including minerals) and its third ranked supplier of imports to Thailand (including minerals) after Japan and China. Although Thailand's traditional major markets have been Europe, Japan, and North America, export growth has also been high in some of Thailand's nontraditional export markets, including China, India, and the Middle East (U.S. Department of State, 2009).

In 2008, Thailand's exports to the United States were valued at $23.5 billion compared with about $22.8 billion in 2007 and $22.5 billion in 2006. Of these exports, crude petroleum accounted for about $465 million; other gemstone (precious, semiprecious, and imitation), about $267 million; iron and steel products, about $199 million; iron and steel mill products (semifinished), about $134 million; finished metal shapes and advanced manufactured products, about $128 million; and advanced iron and steel manufactured products, about $106 million. The values of other exported metals, including nickel, steelmaking and ferroalloying materials, and tin, all increased (U.S. Census Bureau, 2008b).

Imports from the United States were valued at $9.1 billion in 2008 compared with about $8.3 (revised) billion in 2007 and $7.9 (revised) billion in 2006. These imports included nearly $452 million in steelmaking materials; $258 million in petroleum products; and $133 million in gem diamond. Imports that increased in value also included metals, such as aluminum and alumina, copper, finished metal shapes, nonmonetary gold, and iron and steel mill products; other nonferrous metals; energy fuels, such as fuel oil, metallurgical-grade coal, natural gas, natural gas liquids, nuclear fuel materials, and other coal and fuels; and nonmetallic minerals (U.S. Census Bureau, 2008a).

Structure of the Mineral Industry

Thailand's mineral industry consisted of an industrial mineral mining and processing sector and a ferrous and nonferrous metals mining and processing sector. The Electricity Generating Authority of Thailand (EGAT), which was a state enterprise under the Ministry of Energy, and several coal mining companies owned and operated most of the country's major coal exploration and mining businesses. The Petroleum Authority of Thailand (PTT), PTT Exploration and Production Public Co. Ltd. (PTTEP), joint ventures of PTTEP, and major multinational oil companies owned most of the country's oil and gas exploration and exploitation businesses. Private companies in Thailand owned and operated most of the nonfuel minerals mining and mineral processing businesses (table 2).

Commodity Review

Metals

Aluminum.—In 2008, Thailand consumed 0.4 million metric tons (Mt) of refined aluminum, imported 0.4 Mt of aluminum and 0.2 Mt of semifinished aluminum alloys, and exported 0.03 Mt of aluminum. The major aluminum and aluminum alloy suppliers to Thailand were Australia (49%), the United Arab Emirates (13%), Russia (10%), China (8%), and South Africa (7%). Thailand exported aluminum and aluminum alloys mainly to Indonesia (17%), Hong Kong (5%), and Japan (4%) (World Bureau of Metal Statistics, 2009, p. 9-13).

Copper.—The Puthep copper exploration project was a joint venture between Padaeng Industry Public Co. Ltd. (PDI) of Thailand and Pan Australian Resources Ltd. (PanAust) of Australia. As of December 31, PanAust held a 33.17% interest in this project, and the company expected to increase its interest in the project to a total of 51% by completing a feasibility study; it would then have a further option to increase its total interest in the project to between 60% and 70%. Padaeng Industry Public Co. owned the remaining interest in the project. The Puthep copper project is located near the major Provincial center of Loei in northeastern Thailand. The feasibility study that was begun in early 2007 was expected to be completed in late 2009 for announcement in early 2010. The scope of the feasibility study was to include a review of copper leaching options for processing the predominantly chlorite copper mineralization (Pan Australian Resources Ltd., 2009).

Thai Copper Industries Public Co. Ltd. (TCI) was established in July 1994. The company owned a copper smelter with a design capacity of 165,000 metric tons per year (t/yr) of copper cathodes. Construction of the smelter, which started at Rayong Industrial Park in October 1995, was suspended in February 1998 because of the Asian economic crisis. The project was resumed in January 2003, and began producing smelted and refined copper in July 2004. The plant produced refined copper with 99.99% purity and copper cathode for the domestic market. TCI's target customers included the electrical wire and enameled copper wire industrial sectors. From September 2005 through December 2006, the smelting operation of the plant was shut down to overhaul the plant and perform maintenance work. TCI closed in April 2007; no copper was produced in 2008 (Thai Copper Industries, 2007).

Gold.—Amanta Resources Ltd. of Canada continued its initial gold drilling program at the Langu property through 2008. The Langu property is located in Satun Province in southern Thailand. It consists of four special prospecting licenses (Amanta Resources Ltd., 2009).

Kingsgate Consolidated Ltd. (Kingsgate) of Australia owned and operated the Chatree gold mine in central Thailand through its wholly owned subsidiary Akara Mining Ltd. The Chatree gold mine is located 280 kilometers north of Bangkok. In 2008, Kingsgate's ore feed for the plant averaged only 1.1 grams per metric ton gold, which was the main reason for the decrease in gold production (Kingsgate Consolidated Ltd., 2008).

Iron Ore and Iron and Steel.—In 2008, Thailand's iron ore production increased by about 6% to 1.7 Mt from 1.6 Mt in 2007; crude steel production decreased by about 7% to 5.2 Mt from 5.6 Mt; and steel semimanufacturers decreased by about 4% to 7.6 Mt from 7.8 Mt in 2007. The country's imports of steel products increased owing to the stockpiling of hot-rolled coil, which was used to produce automotive parts, and exports of steel decreased owing to the decrease in sales in the world markets. In 2008, Thailand consumed 0.7 Mt of iron in 2008, and 5.3 Mt of iron and steel scrap, which accounted for 37% of the total scrap consumed in the Southeast Asia region (South East Asia Iron and Steel Institute, 2009; World Steel Association, 2009).

Tin.—Thailand Smelting and Refining Co. Ltd. (Thaisarco) was the only tin smelter in Thailand. It was managed by Amalgamated Metal Corporation PLC of the United Kingdom. In 2008, in order to meet the demand of its Asian customer base, Thaisarco imported 22,569 t of tin (contained). The company was affected by the worldwide economic downturn at the end of 2008, and its production and sales for 2009 were expected to decline by approximately 15% to 18,500 t. Thaisarco also had an offshore tin exploration project, which was also affected by the low tin price (Mining Journal, 2009, p. 21).

Tungsten.—On May 21, Amanta Resources Ltd. announced that it had signed a contract with Global Prospectors and Consultants (a Thai mining services company). Amanta's objective was to begin the rehabilitation of the former Mae Lama tungsten mine in northern Thailand, and to develop between 0.5 and 1 Mt of minable tungsten resources. The reported grade for the former Mae Lama operation was 2% WO_3, and the program aimed to verify this as an expected average ore grade for the resumption of tungsten production at the mine (Amanta Resources Ltd., 2008).

Zinc.—Thailand's domestic consumption of zinc in 2008 totaled 112,005 t, which was an increase of 4.7% compared with that of the previous year. PDI operated a zinc mine and smelter with a capacity of 115,000 t/yr, and also conducted zinc ore exploration both in Thailand and in neighboring countries. The company's head office was located in Bangkok, and its mine and plant locations are listed in table 2. PDI's major shareholdings were held by Bali Ventures Ltd. (21.7%), the Thai Ministry of Finance (13.81%), and the United Arab Emirates' RAK Minerals & Metals Investments (12.5%). PDI reported that production of zinc metal in 2008 was 104,134 t, zinc sales were 103,719 t, and zinc exports were 19,350 t. In addition, PDI imported zinc concentrate (zinc sulfide) from Australia and Peru. The company, however, was affected by the global economic downturn, a 50% decrease in the price of zinc, the higher freight rate for ore transport (particularly between South America and Thailand), and a mining interruption of more than 6 months that took place at PDI, which together caused the company's 2008 revenues to decrease by about 33% compared with results achieved the previous year. PDI renewed its Mae Sot Mine mining lease for an additional 15 years on April 8 and resumed zinc mining in this area (Mining Journal, 2009, p. 17; Padaeng Industry Public Company Ltd., 2009).

Industrial Minerals

Cement and Gypsum.—Thailand was one of the world's leading producers of gypsum and produced 8.5 Mt in 2008. In 2008, the domestic cement demand decreased by about 5%; the decrease was caused by decreased local construction activities; flooding, which delayed construction projects; and lower Government investment expenditures (International Cement Review, 2008a, b; Mining Journal, 2009, p. 19).

Siam City Cement Co. Ltd. (SCCC) reported that net sales decreased by 7% in 2008 and net profit decreased by 2%. SCCC expected to maintain its domestic market share of 27%. The company was approved to raise its local cement ceiling price by about 13% for portland cement and mixed cement. SCCC had increased its selling price for domestic cement by about 33% and its selling price for exported cement by about 29% compared with that of 2007 (International Cement Review, 2008a; 2009).

The two main gypsum board producers were Siam Gypsum and Thai Gypsum. Thai Gypsum supplied the domestic and overseas markets in Asia, the Middle East region, and North Africa. The company produced 76 million square meters of gypsum board annually. Siam Gypsum was a joint venture between Lafarge S.A. of France (70%) and Siam Cement (30%), and it had three factories in Thailand with a combined annual production capacity of more than 100 million square meters (International Cement Review, 2008a, b; Mining Journal, 2009, p. 19).

Potash.—Italian Thai Development Public Co. Ltd. (ITD) continued to pursue a potash mining license in Udon Thani Province in northeastern Thailand; however, the planned project to produce 2 million metric tons per year of potash faced considerable obstacles in getting off the ground. The local community expressed concerns about the environmental, health, and social implications, as well as the effect that the mine would have on local livelihoods (Mining Journal, 2009, p. 19).

Mineral Fuels

Coal.—Banpu Public Co. Ltd. closed down the last of its coal mines in Thailand after reserves were exhausted in 2008. The company's future mining activities would remain outside of Thailand (Mining Journal, 2009, p. 17).

EGAT is the state-owned electricity generating authority and the leading producer of lignite in Thailand. In 2008, EGAT produced and supplied 16 Mt of lignite to its own 2,625-megawatt powerplant, which was located in Mae Moh. EGAT studied the feasibility of investing in coal mining in Australia and Indonesia to secure imported coal for its future coal-fired powerplants (Mining Journal, 2009, p. 17).

Consumption of domestically produced lignite totaled 18.5 Mt in 2008, of which 16 Mt was consumed by EGAT and 2.5 Mt was consumed as fuel by manufacturers of cement, fiber, lime, and paper; by tobacco curers; and by other users. Consumption of imported coal (mostly anthracite, bituminous, and coking coal) totaled 16 Mt in 2008, of which about 11 Mt was consumed in the industrial sector by manufacturers of cement, iron and steel, and nonferrous metals; 1.7 Mt, by small power producers; and 3.3 Mt, by independent power producers (Energy Policy and Planning Office, 2009a).

Natural Gas and Petroleum.—PTTEP announced in June that the Arthit project had started producing natural gas at a rate of 370 million standard cubic feet per day and condensate at a rate of approximately 19,800 barrels per day (bbl/d). This project was located off the coast of Songkhla in the Gulf of Thailand (MBendi Information Services (Pty) Ltd., 2009; PTT Exploration and Production Public Co. Ltd., 2008).

Production of crude petroleum increased by 7% to an average of 143,935 bbl/d in 2008 from 134,563 bbl/d in 2007 as a result of increased production from the Jusmin oilfields. In 2008, crude petroleum was produced from more than 12 oilfields. The leading onshore oilfield, the Sirikit oilfield, which was operated by Thai Shell Exploration and Production Co. Ltd., averaged 20,942 bbl/d and accounted for 14.5% of the total crude petroleum output in 2008. The leading offshore oilfield, the Benjamas oilfield, which was operated by Chevron Offshore Ltd., averaged 44,960 bbl/d and accounted for 31.2% of crude petroleum production. To meet the raw materials requirements of its seven oil refineries, Thailand imported a total of 295.8 million barrels, or 810,400 bbl/d, of crude oil in 2008. More than 80% of imported crude oil was from the Middle East (Energy Policy and Planning Office, 2009c).

In 2008, condensate was produced from more than 12 gasfields, of which about 27% was produced from the Pailin gasfield; 22%, from the Bongkot gasfield; 15%, from the Arthit gasfield; 12%, from the Erawan gasfield; 12%, from Funan & Jakrawan gasfield; and the remaining 12%, from more than seven smaller fields (Energy Policy and Planning Office, 2009b).

Outlook

Thailand's mining sector, along with the Thai economy, is still facing risks associated with the severe contraction of major trading partners' economies and the slow recovery of private spending. According to the Thailand Fiscal Policy Office of the Ministry of Finance, in 2009, the country's economy in terms of the real GDP growth would continue to contract by about 3% compared with 2.6% in 2008. Private investment and consumption would continue to decrease as unemployment increased as a result of the contracting economy. As a result of decreased oil prices compared with those of 2008, however, the strengthening of the Baht, and the trade surplus, which includes minerals and mineral products trade, the country's economic stability is expected to improve in 2009 (Ministry of Finance, 2009).

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TABLE 1
THAILAND: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
METALS						
Antimony:						
Ore:						
Gross weight		110	735	2,980	--	--
Sb content		52	347	1,409	--	--
Metal, smelter		2	460	544	271	422
Copper, metal, refined:						
Primary[e]		18,100 [2]	13,700	25,300	11,900	--
Secondary[e]		1,900 [2]	2,100	1,750	814	438
Total		20,000	15,800	27,050	12,714	438
Gold	kilograms	4,500	4,400	4,300	3,401 [r]	2,721
Iron and steel:						
Iron ore:						
Gross weight		135,580	230,946	264,289	1,554,860	1,709,750
Fe content[e]		68,000	116,000	132,000	779,000	855,000
Crude steel	thousand metric tons	4,533	5,161	4,914 [r]	5,565 [r]	5,211
Lead, metal, refined, secondary		57,500	61,100	61,160	73,159	73,303
Manganese ore:						
Metallurgical-grade, gross weight, 46% to 50% MnO_2		4,550	88,500	--	9,500 [r]	111,000
Mn content[e]		2,180	42,400	--	4,550	52,700
Silver	kilograms	10,700	14,100	11,800	7,727 [r]	5,465
Tantalum, metal and oxide powder		317	150	230	142	158
Tin:						
Concentrate:						
Gross weight		724	188	225	149	235
Sn content		586	158 [e]	190 [e]	122	169
Metal, primary		20,800	31,600	27,540	23,104	21,860
Tungsten concentrate:						
Gross weight		337	622	546	923 [r]	1,112
W content[e]		187	345	303	512 [r]	778
Zinc:						
Ore:						
Gross weight		199,477	203,810	214,023	176,042	118,739
Zn content		43,400 [e]	30,572	32,100 [e]	32,921	17,811
Metal, primary		68,300	60,866	94,779 [r]	99,337 [r]	107,753
Alloy, Zn content		46,800	40,320	61,600 [r]	64,600 [r]	70,000
INDUSTRIAL MINERALS						
Barite		115,100	101,186	96,469	8,631 [r]	9,180
Cement, hydraulic	thousand metric tons	35,626	37,872	39,408	35,668	35,668
Clays:						
Ball clay		610,193	393,935	1,003,267	563,353	1,499,993
Kaolin, marketable:						
Beneficiated, washed		200,671	156,853	157,900	159,186	162,215
Nonbeneficiated, unwashed		430,364	580,376	675,886	518,143 [r]	479,443
Filler		--	9,031	9,326	7,985	6,061
Diatomite		1,372	990	1,344	1,260	4,075
Feldspar		1,001,053	1,149,717	1,067,684	684,668	670,618
Fluorspar, crude, metallurgical-grade		2,375	295	3,240	1,820	29,529
Gemstones	thousand carats	911	699	81	102	32
Gypsum	thousand metic tons	7,169	7,113	8,355	8,643	8,500
Perlite		6,000 [e]	5,500 [e]	22,000	6,400	7,000
Phosphate rock, crude		2,580	3,020	900	3,550	3,675
Salt:						
Rock		1,031,200	1,074,214	1,008,251	1,134,931	1,211,581
Other[e]		100,000	100,000	100,000	100,000	100,000
Sand, silica, glass		587,655	718,320	861,847	844,071	495,848

See footnotes at end of table.

TABLE 1—Continued
THAILAND: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
INDUSTRIAL MINERALS—Continued						
Stone:						
Calcite		436,628	692,850	625,950	672,580	823,706
Dolomite		992,907	795,466	899,512	1,108,425 [r]	1,353,763
Granite:						
Dimension stone	cubic meters	10,000 [e]	9,500 [e]	8,321	10,515	10,579
Industrial rock	thousand metric tons	3,500 [e]	3,000 [e]	4,463	5,229 [r]	5,190
Limestone:						
Dimension stone	do.	--	--	201	233	233
For cement manufacture only	do.	63,196	55,584	61,583	63,799	54,885
Construction and other uses	do.	70,000	75,000 [e]	87,887	87,402	87,000
Marble, dimension stone and fragment	cubic meters	236,643	267,797	547,582	848,806	664,930
Marl for cement manufacture only		184,750	196,500	68,700	31,750	41,720
Quartz		19,216	2,604	2,897	4,924	3,290
Shale for cement manufacture only	thousand metric tons	3,622	3,695	5,590	4,769	4,026
Travertine		--	--	3,316	3,490	3,640
Talc and related materials:						
Pyrophyllite		108,691	177,684	131,843	415,420	106,600
Talc		12,592	10,270	4,374	3,508	3,264
Zirconium		--	--	--	1,023	--
MINERAL FUELS AND RELATED MATERIALS						
Coal, lignite	thousand metric tons	20,038	21,429	19,071	18,239	18,095
Natural gas, gross production	million cubic meters	22,360	23,689	24,317	25,400	25,400
Petroleum:						
Crude	thousand 42-gallon barrels	31,299	41,570	47,067	48,745 [r]	53,151
Natural gas condensate	do.	24,963	25,363	27,466	28,778 [r]	31,340
Refinery products:						
Liquefied petroleum gas	do.	41,520	45,241	45,475	48,759 [r]	53,842
Gasoline	do.	56,339	58,072	57,172	54,739 [r]	53,142
Jet fuel	do.	29,127	30,421	35,240	33,478 [r]	37,750
Kerosene	do.	7,041	6,395	6,548	776 [r]	1,226
Distillate fuel oil	do.	42,277	38,740	39,681	40,581 [r]	43,231
Residual fuel oil[e]	do.	24,000	25,000	26,000	27,109 [2]	26,500
Unspecified[e, 3]	do.	3,600	3,600	3,600	3,626 [2]	3,600
Total[e, 4]	do.	204,000	207,000	214,000	209,000 [r]	219,000

[e] Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r] Revised. do. Ditto. -- Zero.

[1] Table includes data available through December 4, 2009.

[2] Reported figure.

[3] Includes refinery fuel and refinery gains or losses.

[4] Data are rounded to three significant digits; may not add to totals shown.

Sources: Department of Mineral Resources, Mineral Statistics of Thailand; Department of Primary Industries and Mines; Ministry of Energy, Energy Policy and Planning Office; and U.S. Geological Survey Minerals Questionnaires, 2004-2008.

TABLE 2
THAILAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Barite		Asian Mineral Resources Co. Ltd.	Loei, Mae Hong Son, Nakhon Si Thammarat, and Satun Provinces	60
Do.		P&S Barite Mining Co. Ltd.	Loei and Nakhon Si Thammarat Province	60
Cement		Asia Cement Co. Ltd.	Pra Phutthabath, Saraburi Province	4,800
Do.		Jalaprathan Cement Co. Ltd. (Cement Francais S.A., 37%; Veatprapat Holding Co. Ltd., 19%; others, 44%)	Takli, Nakhorn, Sawarn Province; and Cha-Am, Petchburi Province	2,350
Do.		Samukee Cement Ltd.	Pakchong, Nakhon Ratchasima Province	125
Do.		Saraburi Cement Co. Ltd. (CEMEX Asia Holdings Ltd., 99%)	Chalerm Phrakiat, Saraburi Province	700
Do.		Siam Cement Industry Co. Ltd. (Bureau of the Crown Property, 30%; Thai Security Depository Co. Ltd., 6.94%; CPB Equity Co. Ltd., 5.6%; other financial institutions and the general public, 57.46%)	Kaeng Khoi, Phabhudhabat, and Khao Wong, Saraburi Province; Chae Hom, Lampang Province; Thung Song, Thammarat Province; and Ta Luang, Ayutthaya Province	23,200
Do.		Siam City Cement Co. Ltd. (SCCC) (Holcim Ltd., 33.7%; Rattanarak family, 27%; other investors, 39.3%)	Kaeng Khoi, Saraburi Province	14,500
Do.		TPI Polene Co. Ltd.	do.	9,900
Coal, lignite		Electricity Generating Authority of Thailand (EGAT) (Government, 100%)	Mae Moh, Lampang Province	20,000
Do.		Lanna Lignite Public Co. Ltd.	Ban Pakha, Lamphun Province	1,000
Copper		Thai Copper Industries Public Co. Ltd. (TCI)	Rayong Industrial Park	165
Feldspar, concentrate		Asia Mineral Processing Co. Ltd.	Provinces of Nakhon Si Thammarat and Trang	500
Fluorspar, concentrate		Asian Mineral Resources Co. Ltd.	Mae Hong Son Province	14
Gas, natural	million cubic meters per day	Esso Exploration and Production Khorat Inc.	Namphong, Khon Kaen Province	4
Do.	do.	TOTAL Exploration and Production (Thailand)	Bongkot in the Gulf of Thailand	15
Do.	do.	Unocal Thailand Ltd.	Baanpot, Erawan, Funan, Kaphong, Pladang, Satun, Pailin, Trat, all in the Gulf of Thailand	33
Gold	kilograms	Akara Mining Ltd. (Kingsgate Consolidated Ltd., 100%)	Chatree, Phichit Province	5,000
Gypsum		Vanich Gypsum Co. Ltd.	Khlong Prab, Mai Riang. Thoong Yai Mai in the Provinces of Nakhon Si Thammarat and Surat Thani	8,500
Do.		Lotus Mines Co. Ltd.	Nakornsawan	NA
Do.		General Mining and Trading Co. Ltd.	Talad, Muang	NA
Iron ore, gross weight		P.T.K. Mining Co. Ltd.	Phu Ang, Loei Province	720
Lead, in concentrate		Kanchanaburi Exploration and Mining Co. Ltd.	Song Toh, Nong Phai, and Bo Ngam in Kanchanaburi Province	30
Petroleum, crude, including condensate	thousand 42-gallon barrels per day	Chevron Offshore (Thailand) Ltd.	Benjamas, Tantawan, offshore in the Gulf of Thailand	35
Do.	do.	PTT Exploration and Production Public Co. Ltd. (PTTEP)	Arthit, Songkhla of Gulf of Thailand	20
Do.	do.	Tahi Shell Exploration and Production Co. Ltd.	Sirikit in Kamphaenghet Province	24
Do.	do.	TOTAL Exploration and Production (Thailand)	Bongkot, offshore in the Gulf of Thailand	12
Do.	do.	Unocal Thailand Ltd.	Baanpot, Erawan, Funan, Gomin, Jakrawan, Kaphong, Pailin, Platon, Satun, Surat, Trat Plamuk, offshore in the Gulf of Thailand	38
Steel, rolled		The Bangkok Iron and Steel Works Co. Ltd.	Phrapradaeng, Samutprakarn Province	120
Do.		Bangkok Steel Industry Public Co. Ltd.	do.	300
Do.		Tata Steel (Thailand) Plc (Tata Steel Ltd., 67.11%; McDonald Investment, 6.5%; other investors, 26.39%)	Map Ta Phut, Rayong Province; Sriracha, Chonburi Province; Ban Mon, Saraburi Province	1,700
Do.		Namheng Steel Co. Ltd.	Lopburi Province	300
Do.		Sahaviriya Group Corp. Ltd.	Bang Saphan, Prachuap Khiri Khan Province	2,400
Do.		Siam United Steel Co. Ltd.	Rayong Province	1,000
Do.		G-Steel Plc (formerly Siam Ystrip Mill Plc)	Map Ta Phut, Rayong Province	600

See footnotes at end of table.

TABLE 2—Continued
THAILAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Tantalum, metal powder and oxides	metric tons	H.C. Starck (Thailand) Co. Ltd. (H.C. Starck GmbH, 94.98%, and others, 5.02%)	Map Ta Phut, Rayong Province	250
Tin:				
Concentrate		Numerous small companies	Nakhon Si Thammarat, Phangnga, Phuket, and Rayong Provinces	3
Refined		Thailand Smelting and Refining Co. Ltd. (Thaisarco) (Amalgamated Metal Corporation PLC, 75.25%, and other, 24.75%)	Phuket, Phuket Province	30
Tungsten, in concentrate	metric tons	SC Mining Co. Ltd. (Som Chai family, 100%)	Ban Pin, Chiang Mai Province	650
Zinc:				
In concentrate		Padaeng Industry Public Co. Ltd. (PDI) (Bali Ventures Ltd, 21.7%; Thai Ministry of Finance, 13.81%; RAK Minerals & Metals Investments, 12.5%; others, 52%)	Mae Sot district, Tak Province	65
Refined		do.	Smelter in Muang district, Tak Province; Roaster plant in Rayong Province	115

Do., do. Ditto. NA Not available.

THE MINERAL INDUSTRY OF VIETNAM

By Yolanda Fong-Sam

Vietnam is endowed with a variety of mineral resources, and about 5,000 ore deposits had been discovered for approximately 70 types of minerals. In 2008, Vietnam produced about 1% of the world's barite, cement, and tin, and ranked seventh in the production of crude petroleum in the Asia and the Pacific region (U.S. Energy Information Administration, 2008; Carlin, 2010; Miller, 2010; van Oss, 2010). In addition, the country produced chromium ore, coal, copper, natural gas, lead, lime, salt, steel, and zirconium (table 1; Mining Journal, 2008).

Minerals in the National Economy

According to the General Statistics Office of Vietnam, the output value of the mining and quarrying sector (which included mineral fuels and nonfuel minerals) in 2008 was estimated to be $1.3 billion (in 1994 constant dollars). This was equivalent to 4.3% of the country's total estimated gross domestic product of $30.28 billion (in constant 1994 dollars) (General Statistics Office of Vietnam, 2009a).

Government Policies and Programs

The mining industry in Vietnam is governed by the following three regulatory instruments: the Mineral Law (enacted in March 1996); Decree 68 (enacted in November 1996), which regulates the implementation of the Mineral Law; and Decision 325 of the Ministry of Industry and Trade (issued in February 1997), which covers administrative procedures concerning mineral activity licenses. Mining rights in the country are administered through a licensing system, which allows the Vietnamese Government to control access to mining and to define the terms under which mining may take place. The Mineral Law stipulates that all the mineral resources of Vietnam are owned by the people and are to be managed by the state. The Ministry of Industry and Trade oversees the country's mineral resources sector and manages all aspects of the mining industry; it is the only authority that issues mining licenses, which include licenses for prospecting, exploration, extraction, and processing. The Department of Geology and Minerals of Vietnam, which is under the Ministry of Natural Resources and Environment, assists in the management of the mineral resources of the country. Specific functions include assessing the mineral resources in Vietnam, discovering mineral deposits, establishing an updated geologic and mineral resources survey of the country, monitoring mineral activities, and protecting mineral resources (Burns and others, 1998, p. 1, 5, 25, 27; Department of Geology and Minerals of Vietnam, 2010).

In 2008, Vietnam's Ministry of Finance introduced a new decree (Decision 35/2008/QD-BTC) that dictates an increase in tariffs on mineral exports; the new tariffs went into effect on June 16, 2008. The purpose of the measure was to reduce exports of coal and crude oil in anticipation of the commissioning of Vietnam's first refinery, the Dung Quat plant, which would have the capacity to produce 140,000 barrels per day. The plant was set to start operations in February 2009. The trade between Vietnam and its international partners could be affected by the increase in tariffs given that Vietnam was a major supplier of coal to China and a major crude oil exporter to Southeast Asia. The increase in tariffs was also intended to regulate exports to ensure that the domestic demand for energy is met. The proposed tariff would be wide-ranging for fertilizers (up to 50%), crude oil and natural gas (up to 40%), minerals (up to 30%), and materials and semifinished products, which had been tax free (up to 20%). For example, the export tariff of zircon ore increased to 20% from 15%, and the tariff on zircon concentrate increased to 20% from 10% (Intellasia.net, 2008; Tran, 2008, p. 72).

In June 2008, the Ministry of Industry and Trade issued Circular 08, which established a ban on the export of titanium minerals, such as ilmenite, rutile, and zircon sand. Vietnam was a major supplier of titanium minerals to such countries as Brazil, Japan, Malaysia, the Republic of Korea, and the United States. Vietnam's leading ilmenite producer, Ha Tinh Mining and Trading Corp. (Mitraco), proposed an acceleration in the construction of a domestic titanium oxide processing plant, which had been delayed for several years owing to funding limitations. The proposed project consisted of a 30,000-metric-ton-per-year (t/yr)-capacity plant located in the Province of Ha Tinh about 370 kilometers (km) south of Hanoi. The estimated investment was $125 million. Mitraco had been mining in the Ha Tinh central coastal area since 1991 when it was established by the Vietnamese Government; the company had an annual processing rate of more than 100,000 t of ilmenite, 11,000 t of zircon, and 2,000 t of rutile. Most of the ilmenite produced in the country was exported to pigment producers in Japan, Malaysia, and the Republic of Korea (Tran, 2008, p. 73).

Production

Vietnam produced the following major mineral commodities: barite, chromite, coal, ilmenite, limestone, crude petroleum, phosphate rock, tin, and zinc. As for major processed minerals, Vietnam produced cement, refined copper, rolled steel, refined tin, and zinc. During 2008, mineral production increased mainly for phosphate rock (which increased by 37.8%), lime (16.8%), rutile (15.2%), natural gas (12.2%), crude steel (11.2%), and rolled steel (10%). Mineral commodities for which production decreased significantly were chromium ore (which decreased by 46.2%), mined copper (12%), barite (11.1%), and anthracite and crude petroleum (6.4% each) (table 1).

Structure of the Mineral Industry

The structure of Vietnam's mineral industry can be classified into the following three major categories: state-owned enterprises that produced, distributed, and traded mineral commodities; foreign companies that held a joint-venture agreement with state-owned enterprises; and foreign companies that had been granted mineral exploration licenses. The major state-owned companies were Vietnam National Cement Corp. (VNCC), which managed all state-owned cement plants; Vietnam National Chemical Corp., which managed all state-owned fertilizer-related minerals mining and processing companies; Vietnam National Coal Corp. (VINACOAL), which managed all state-owned coal mining and processing companies; Vietnam National Minerals Corp. (VIMICO), which managed all state-owned nonferrous minerals mining and processing companies; Vietnam National Salt Corp., which managed all state-owned salt producing companies; and Vietnam Steel Corp. (VNSTEEL), which managed all state-owned iron ore mining and steelmaking companies (Vietnam Financial Review, 2009).

According to the Government of Vietnam statistics, the number of employees working in the mining and quarrying sector in 2008 was approximately 431,200, which accounted for about 1% of the total number of employed people in the country (44,915,800) (General Statistics Office of Vietnam, 2009b).

Mineral Trade

In 2008, total trade in Vietnam increased by about 28.8% to $143.4 billion from $111.3 billion in 2007. The total value of exports increased by approximately 29% to $62.7 billion from $48.6 billion in 2007. The total value of imports was $80.7 billion compared with $62.8 billion in 2007, which was an increase of about 28.5%. Exports of tin increased by 8.7% to 2,500 metric tons (t) in 2008 from 2,300 t in 2007; exports of coal decreased by 39.6% to 19.4 million metric tons (Mt) from 32.1 Mt, and exports of crude oil decreased by 8.2% to 101 million barrels (Mbbl) from 110 Mbbl. Imports of refined petroleum products decreased by 1.75% compared with imports in 2007, but imports of iron and steel increased by 1.82%. The import value of chemicals and plastics totaled $4.72 billion in 2008, which was an increase of 16.3% compared with $4.06 billion in 2007. In 2007 (the latest year for which data were available), the value of metal imports increased noticeably for aluminum to $660 million from $513 million in 2006, or by about 32%; copper, to almost $900 million from $767 million, or by about 17.1%; lead, to $148 million from $58 million, or by about 155%; and zinc, to $204 million from $144 million, or by about 42% (General Statistics Office of Vietnam, 2009c-f).

In 2008, Vietnam's main trading partners were Australia, China, Japan, the Republic of Korea, Singapore, Taiwan, Thailand, and the United States. In 2008, the leading importer of Vietnamese goods was the United States, which imported $11.9 billion, or about 18.9% of Vietnam's total exports followed by Japan with $8.54 billion, or 13.6% of total Vietnam's exports, and China with $4.54 billion or 7.2% of total Vietnam's exports. In 2008, imports to Vietnam were supplied mainly by China (19.4% of total imports valued at $15.6 billion), Singapore (11.6% of total imports valued at $9.4 billion), and Taiwan (10.4% of total imports valued at $8.4 billion).

Commodity Review

Metals

Bauxite and Alumina and Aluminum.—Vietnam's bauxite resources consist of diaspore bauxite and gibbsite bauxite. Diaspore bauxite occurs in the northeastern part of the country in the Provinces of Cao Bang, Ha Giang, and Lang Son, where reserves were estimated to be 91 Mt of ore. As of 2008, 36 deposits and ore occurrences had been discovered in the Lang Son area. In December, the Vietnamese prime minister authorized the Province of Cao Bang to negotiate mining joint ventures with foreign partners to explore the districts of Phuc Hoa and Quang Yen. The agreement required Vietnam to be the majority stakeholder. Gibbsite bauxite was found mainly in the central highlands of the country in Thai Nguyen Province. Gibbsite reserves were estimated to be 5.4 billion metric tons (Gt) (Mining Journal, 2008; VietNamNet, 2008; Vietnam National Coal-Mineral Industries Group, 2009).

The Vietnam National Coal-Mineral Industries Group (VINACOMIN) was the Government entity that regulated such mineral industries as aluminum, coal, construction materials, metallic minerals, and power generation. VINACOMIN had several projects that it planned to implement after 2010, including the construction of three aluminum smelters—the Binh Thuan and the Quang Ninh aluminum smelters, which were expected to have a capacity of 300,000 t/yr each, and the Lam Dong aluminum smelter (Vietnam National Coal-Mineral Industries Group, 2009).

In late 2007, the Vietnamese consulting organization Institute of Mining-Metallurgical Science and Technology (IMMST) was assigned by the Ministry of Industry and Trade to develop a master plan for the use of bauxite from Thai Nguyen Province, which has large reserves of bauxite. The plan, which was approved by the prime minister of Vietnam in Decision 167/2007/QD-TTg of November 2007, proposed utilization of the bauxite resources to produce quality alumina that would be used for aluminum electrolysis. The IMMST estimated that alumina output would be 0.7 to 1 million metric tons per year (Mt/yr) by 2010, 6 to 8.5 Mt/yr by 2015, and 13 to 18 Mt/yr by 2025. The IMMST also proposed to continue exports of alumina until 2015, and thereafter to reduce the quantity of exports to help meet domestic demand. In 2008, VINACOMIN signed an agreement to sell to China's Yunnan Metallurgy Group between 600,000 and 900,000 t/yr of alumina products from VINACOMIN's facilities at the Lam Dong bauxite-aluminum complex and the Nhan Co. bauxite-alumina complex for a period of 30 years. VINACOMIN was the Government entity assigned to oversee the implementation of the bauxite project in Thai Nguyen (Ministry of Natural Resources and Environment, 2009).

In July 2008, VINACOMIN signed an engineering, procurement, and construction (EPC) contract with the Chinese company China Aluminum International Engineering Co. (Chalieco) to build a $460 million alumina plant in the central highlands of Vietnam to be completed in 2010. The plant, which was designed to have a capacity of 600,000 t/yr of alumina, was part of the Tan Rai bauxite and aluminum complex, which was located 300 km northeast of Ho Chi Ming City in the Province of Lam Dong. The existing Tan Rai plant, which had been built in 2006, was originally proposed to be the country's first bauxite and alumina plant, but owing to financial limitations and frequent domestic power shortages, the project was completed as a bauxite-only plant (Thanhnien News, 2008a).

In August 2008, a cooperation agreement was signed between the aluminum producers Alcoa World Alumina and Chemicals (AWAC) (an affiliate of Alcoa Inc. of the United States) and VINACOMIN for the development of an alumina refinery with the capacity to produce 600,000 t/yr, which was proposed to be located in the central highlands of Dac Nong Province. The agreement provided for an annual royalty of 10% of the refinery's net profits to be paid to the Vietnamese Government. Alcoa and VINACOMIN also proposed a feasibility study for a separate project that included a metallurgical-grade alumina refinery project and a bauxite mine. Under the agreement, AWAC would have the right to purchase a 40% stake in a joint-stock company that owned the Nhan Co. bauxite mine and a 600,000-t/yr alumina refinery located in Lam Dong Province; VINACOMIN would hold a 51% share, and the remaining 9% shareholding would be held by the Vietnamese people. As part of the agreement, another feasibility study would be conducted by AWAC on the Gia Nghia bauxite mine and alumina refinery in Dac Nong Province, from which AWAC hoped to produce between 1 and 1.5 Mt/yr of alumina when in production (Thanhnien News, 2008d; Tran, 2008, p. 75).

By 2025, the Vietnamese Government planned to invest $15.6 billion to expand its bauxite and alumina industry. The investment would go towards the developing mines and refineries in the country (Thanhnien News, 2008a).

Gold.—In 2008, the deputy prime minister of Vietnam signed an agreement that authorized the reopening of six gold sites for mining. The mine sites are located in the Dai Loc and the Tay Giang districts, and consist of small reserves that, while not deemed to be suitable for large industrial-scale mining, were appropriate for artisanal mining (Thanhnien News, 2008b).

The Canada-based mining company Olympus Pacific Minerals Inc. owned two gold projects in Vietnam—the Bong Mieu and the Phuoc Son. In December 2008, Olympus concluded a 3-month trial test by treating the high-grade ore from the Phuoc Son property in the Bong Mieu gold plant. During 2008, the Bong Mieu plant was upgraded to improve its processing efficiency; as a result, the plant produced 348 kilograms (reported as 11,191 troy ounces) of gold in 2008. The ore from the Phuoc Son property was transported to the Bong Mieu upgraded facility; both properties were located near the port city of Da Nang in the central coastal region of the country. The Phuoc Son processing plant was expected to be commissioned in the near future (Olympus Pacific Minerals Inc., 2008, p. 3; 2009).

Iron and Steel.—Vietnam was estimated to have more than 200 iron ore deposits, located mainly in the northern Provinces of Cao Bang, Ha Giang, Ha Tinh, Thai Nguyen, and Yen Bai. The total estimated iron ore reserve in the mentioned areas was about 1,200 Mt in 13 deposits that were estimated to contain more than 1 Mt each (Mining Journal, 2008).

In 2007, the Indian company Tata Steel Group signed a memorandum of understanding with Vietnam Steel Corp. (VNSTEEL) for the construction of a steel mill in Vietnam. The memorandum was followed by a joint-venture agreement signed by Tata Steel, Vietnam Cement Industries (VICEM), and VNSTEEL to build the steel complex. Tata Steel was expected to hold a 65% stake in the joint venture. Tata Steel held a 30% interest in another project in Vietnam, the Thach Khe iron ore mine, which had a projected production capacity of 4.5 Mt/yr and was located 60 km from the steel plant (Vietnam Business Finance News, 2008b; Tata Steel Group, 2009, p. 57).

At the beginning of 2008, the Ministry of Planning and Investment of Vietnam reported a favorable feasibility study for the largest iron ore deposit in the country, the Thach Khe. As a result, the country estimated that an investment of $850 million would be necessary to build the infrastructure needed for the development of the deposit, which included a port. Stakeholders for the Thach Khe project included Tata Steel and VINACOMIN (30% each), VNSTEEL (20%), Song Da Corp. and the Bank for the Development of Vietnam (5% each), and Ha Tinh Mining and Trading Corp. (4%). VNSTEEL planned to have a mine output capacity of 10 Mt of ore to be used both domestically and for export (Ho Chi Minh City Department of Industry and Trade, 2008).

In September 2008, the Vietnam Shipbuilding Industry Group (VINASHIN) and Malaysia-based Lion Diversified Holding Berhard announced its intent to seek Government approval to build a 10-Mt/yr steel complex in Ninh Thuan Province at an estimated cost of $10 billion. The proposed complex, which would be fed by coal and iron ore, included a blast furnace, a 1,450-megawatt powerplant, and a seaport located in an area of 1,650 hectares. When the complex is operational, the production capacity was projected to be 4.5 Mt/yr of steel in the first stage (from 2008 to 2010) and 10 Mt/yr thereafter (Vietnam Business Finance News, 2008b).

The Government of Vietnam planned to import approximately 5 Mt/yr of steel in 2009 to meet domestic demand, which was projected to be 10.5 Mt and included the requirements of such industries as automakers and the construction industry. The Ministry of Industry and Trade projected that the demand for steel in 2009 would be 4.95 Mt when taking into account the demand of the construction sector and the export goals of the country (Thanhnien News, 2008e).

Nickel.—Canada-based Asian Mineral Resources Ltd. announced in September that it would place its Ban Phuc nickel and copper project on care-and-maintenance status beginning on October 1, 2008. Asian Mineral's decision was based on the export tariff increase established by the Government of Vietnam in June 2008, among other factors, such as the increase in the royalty rate, taxes, and the instability of worldwide metal prices (Marketwire.com, 2008).

Rare Earths.—Vietnam's rare-earth deposits, which are abundant in the northwestern part of the country, had great potential for development. Only small-scale exploitation of rare-earth resources had taken place in Vietnam in the past few years, however. Rare earths from Vietnam were used in the construction and metallurgical industries, as well as for sintering of ceramics and enhancing the quality of glass (Industrial Minerals, 2008, p. 79).

Rare-earth deposits were first discovered in the northwest in Bac Bo in the middle and end of the 1950s. Subsequent exploration followed in the 1960s, mid-1970s, and between 1983 and 1985, which resulted in the discovery of deposits in five areas in northwestern Vietnam in Dong Pao, Muong Hum, north Nam Xe, south Nam Xe, and Yen Phu. Other regions with potential for the discovery of rare-earth deposits were the Provinces of Lai Chau, Lao Cai, and Yen Bai in northwestern Vietnam. Most exploration had been concentrated in Dong Pao and in north and south Nam Xe; ores from these areas are mostly composed of barite, bastnaesite, fluorspar, and strontianite. Exploration for other rare-earth elements in these areas was also being considered, especially exploration for ilmenite, monazite, niobium, rutile, strontium, titanium, uranium, and zircon. Placer deposits with large reserves of monazite had been discovered in the eastern coastal areas of Cat Khanh (approximately 24,000 t), My Tho (about 6,600 t), Quang Ngan (3,300 t), and Vinh My (2,000 t) (Industrial Minerals, 2008, p. 73, 77).

In 2008, ongoing exploration for rare earths was taking place in the Dong Pao, the north Nam Xe, and the south Nam Xe ore deposits, which are located in the Phong Tho District. The north Nam Xe ore deposit consists mainly of apatite, barite, fluorspar, magnetite, and pyrite. The ore was also estimated to contain reserves of uranium (76,000 t), thorium (59,000 t), and niobium (8,000 t). The south Nam Xe ore deposit consists mainly of occurrences of fluorspar, pyrite, thorium, and an estimated reserve of 320,000 t of uranium; 55,000 t of barite; more than 3,000 t of yttrium; and more than 2,000 t of strontium, among others. The Dong Pao deposit, which is located 40 km south of the Nam Xe deposits, was discovered in 1959; geologic studies in the 1960s resulted in the discovery of 60 ore bodies. The main occurrences in this deposit were barite and fluorspar, with rare-earth oxide content that varies from 0.5% to more than 10%. Studies also revealed the presence a variety of oxides, including beryllium, manganese, niobium, strontium, thorium, and uranium. Studies had revealed a reserve of 2.9 Mt of barite, and 1 Mt of fluorspar in the Dong Pao deposit (Industrial Minerals, 2008, p. 77, 79).

Titanium (Ilmenite).—In March 2009, United States-based petroleum company ATI Petroleum (a natural resources exploration group) was planning to increase the capacity of its mineral sand separation facility to 30,000 t/yr of ilmenite. ATI's ilmenite project was located in Ha Tinh Province, where the company had identified a reserve of 5.5 Mt. The company expected to convert the small-scale project into a larger processing facility by the end of 2009 by providing the capacity, manpower, and technology to be able to process ore from other mines (Industrial Minerals, 2009).

Tungsten.—In May 2008, Bayerische Hypo-Und Vereinsbank Bank of Germany and Fortis Bank of Belgium signed a joint-venture agreement with Nui Phao Mining Company Ltd. (Nuiphaovica) (a subsidiary of Tiberon Minerals Ltd. of Canada), and two Vietnamese partners (Thai Nguyen Minerals Co. and Thai Nguyen Export-Import Investment Co.). According to the agreement, the banks would provide a credit of $250 million to finance Vietnam's largest fluorspar and tungsten mining project, which was located in the Province of Thai Nguyen. Production was planned to commence in September 2010 (Vietnam Business Finance News, 2008a).

Industrial Minerals

Cement.—Vietnam expected to cease the importation of cement by 2010, provided production growth continued at its current trend. Vietnam produced about 40.05 Mt of cement in 2008; for the country to reach its goal, the country would need to boost production of cement by approximately 25% by 2010 (Vietnam National Cement Association, undated).

During the first 6 months of 2008, cement consumption in Vietnam reached 17.9 Mt, which was an increase of about 20% compared with the same period in the previous year, which was higher than the 10% to 14% increase that the Ministry of Construction had anticipated. In 2008, local cement prices increased by between 50% and 80% as the year progressed owing to cement shortages and increases in imported cement prices. To ease the situation, in May 2008, the Ministry of Finance released Decision No. 29/2008/QD-BTC, which waived the 40% tariffs imposed on imported clinker as a measure to alleviate the increase in cement prices (Vietnam Financial Review, 2008).

In November 2008, Viet Bac Mining Industry Co., which was a subsidiary of VINACOMIN, started the construction of the Quan Trieu cement plant in Thai Nguyen Province. The plant had an initial design capacity of more than 800,000 t/yr of cement at an investment cost of $77 million. Viet Bac expected the plant to be fully operational by 2010; the company expected to upgrade the facility's production capacity to 3 Mt/yr of cement in the future (Thanhnien News, 2008f).

Mineral Fuels

Coal.—In 2007, the volume of Vietnam's coal exports peaked at more than 32 Mt. During the past few years, the Ministry of Planning and Investment had been working on decreasing exports of coal because of the imminent exhaustion of reserves. The major mines were situated in Quang Ninh Province in the northeastern part of the country and contained coal reserves of 3.5 Gt at 300 meters (m) depth. Larger reserves of more than 200 Gt had been discovered at depths of more than 3,000 m. Based on the Ministry of Industry and Trade estimates, the domestic demand for electricity increased by about 20% annually, at which rate the country would need to start relying on coal imports by around year 2015 (Thanhnien News, 2008c).

Natural Gas and Petroleum.—In 2008, natural gas production in Vietnam increased by 12.2% to 7,944 million cubic meters from 7,080 million cubic meters in 2007. Production of crude petroleum decreased by 6.4% (table 1).

Vietnam's first refinery, the Dung Quat Oil Refinery, was scheduled to start operations in February 2009. The facility, which was located in central Quang Ngai Province, had been built at an estimated cost of $2.5 billion; the expected processing capacity was 6.5 Mt/yr of crude oil and petrochemical products.

The main investor in the Dung Quat refinery was state-owned Vietnam National Oil and Gas Group (PetroVietnam) (Alexander's Gas & Oil Connections, 2008e, f).

In May 2008, construction of a second oil refinery facility was started in the north-central coastal Province of Thanh Hoa about 180 km south of the capital Hanoi. The Nghi Son refinery was part of the Nghi Son Petrochemical Refinery Complex, which had an initial investment estimated to be $6.2 billion; it was scheduled to start operations in 2013 with a designed refinery capacity of 10 Mt/yr of crude oil. PetroVietnam (25.1%) was the state-owned investor for the Nghi Son refinery, along with partners Idemitsu Kosan of Japan and Kuwait Petroleum International (KPI) (35.1% each), and Mitsui Chemicals of Japan (4.7%). KPI was committed to supplying 100% of the crude oil to the refinery, which in turn would produce diesel, jet fuel, kerosene, liquefied petroleum gas, and petrol. When operating at full capacity, refinery No. 1 and refinery No. 2 would meet about 65% of the domestic demand for fuel and petroleum products (Alexander's Gas & Oil Connections, 2008d-f).

The Ministry of Planning and Investment announced in mid-2008 the construction of a petrochemical complex in the Long Son Island commune in the city of Vung Tau in the Province of Ba Ria-Vung Tau. The petrochemical complex project would include Vietnam's third oil refinery facility, the Long Song refinery. The refinery was designed to have a processing capacity of 10 Mt/yr of crude oil when operational in 2013 at a total investment cost of $10 billon (Alexander's Gas & Oil Connections, 2008e, f).

In May 2008, OAO Gazprom of Russia reached an agreement with PetroVietnam for further cooperation, which included geologic exploration and the development of four new blocks offshore Vietnam. Vietgazprom Joint Operating Co., which was a joint-venture company composed of Gazprom and PetroVietnam, was the company in charge of overseeing and operating the project. The parties also considered the establishment of a new joint venture, Gazpromviet, to promote the company's participation and cooperation in promising oil and gas projects in Russia and abroad. In August 2007, Gazprom acquired the right to explore and develop its first offshore gasfield in Vietnam. Test results showed the presence of gas in the Bao Wang (Gold Panther) area (Alexander's Gas & Oil Connections, 2008a, b).

In September 2008, PetroVietnam agreed with Petroleos de Venezuela (PdVSA) to import crude oil from the latter, and invest in the construction of a refinery in Vietnam to process PdVSA's crude. The agreement involved the creation of two joint companies; one for the transportation of the PdVSA's crude to Vietnam, and the other to jointly refine the fuel. In 2008, PetroVietnam also increased its presence in Venezuela by expanding its oil exploration activities in the Orinoco Basin in partnership with PdVSA (Alexander's Gas & Oil Connections, 2008c).

Outlook

Vietnam's mining sector is expected to be dominated by the bauxite, coal, and oil and gas industries for the next 2 to 3 years, mainly as a result of the many exploration projects that were started and the discoveries that were made in 2007 and 2008. Vietnam plans to commission three oil refineries between 2009 and 2013, which would allow the country to decrease its dependency on imports of petroleum products.

The Ministry of Finance's export tariff increase could affect Vietnam's mineral trade performance in the international market for the short run, but it is also likely to give the country the ability to control its exports and regulate the domestic market to meet domestic demand (Intellasia.net, 2008).

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TABLE 1

VIETNAM: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008[e]
METALS						
Bauxite[e]		20,000	25,800	30,000	30,000	30,000
Chromium ore, gross weight		82,000	78,915 [r]	73,037 [r]	103,830 [r]	55,880 [3]
Copper:						
Mine output, Cu content		1,200	3,100 [r]	11,400 [r]	12,500 [r]	11,000
Metal, refined		--	--	4,800	11,000	2,000
Gold	kilograms	2,065	2,138	2,500 [e]	3,000 [e]	3,000
Iron and steel:						
Iron ore, Fe content[e]		495,000	504,700	510,000	530,000	530,000
Metal:						
Pig iron	thousand metric tons	187	202	583	790	800
Steel, crude	do.	689	890	1,869 [r]	2,024 [r]	2,250
Steel, rolled	do.	3,280	3,403	3,837 [r]	4,612 [r]	5,073 [3]
Lead, mine output, Pb content[e]		2,750	7,700 [r]	14,900 [r]	19,200 [r]	19,100
Manganese concentrate, gross weight[e]		15,000	18,000	20,000	20,000	20,000
Pyrite, gross weight[e]	thousand metric tons	450	500	500	500	500
Tin:						
Mine output, Sn content[e]		3,500	3,500	3,500	3,500	3,500
Metal, smelter		2,356	1,766	2,665 [r]	3,369 [r]	3,566 [3]
Titanium:						
Ilmenite concentrate, gross weight[e, 4]		550,000	523,000	605,000	550,000	550,000
Rutile, gross weight		465 [r]	405 [r]	437 [r]	574 [r]	661 [3]
Zinc:						
Mine output, Zn content[e]		45,000	48,000	45,000	46,000	45,000
Metal, powder		5,000	23,000	23,000 [e]	23,000 [e]	23,000
Zirconium, gross weight[e, 5]		39,400	32,500	26,100	22,000 [r]	22,000
INDUSTRIAL MINERALS						
Barite		101,040	116,000	90,000 [r]	90,000 [r]	80,000
Cement, hydraulic	thousand metric tons	26,153	30,808	32,690	37,102 [r]	40,047 [3]
Clays, kaolin[e]		650,000	650,000	650,000	650,000	650,000
Fluorspar[e]		4,000	4,000	4,000	4,000	4,000
Graphite[e]		2,000	2,000	2,000	2,000	2,000
Gypsum[e]	thousand metric tons	5,000	5,000	5,000	5,000	5,000
Lime	do.	1,464	1,737	1,592 [r]	1,438 [r]	1,679 [3]
Nitrogen, N content of ammonia		216,200	220,000	230,000	300,000	300,000
Phosphate rock:						
Gross weight	thousand metric tons	905	1,024 [r]	1,232 [r]	1,523 [r]	2,099 [3]
P_2O_5 content[e]	do.	272	320	365 [r]	390	400
Pyrophyllite[e]		30,000	30,000	30,000	30,000	30,000
Salt	thousand metric tons	906	898	842 [r]	857 [r]	847 [3]
Sand and gravel	do.	145,300	166,000	182,700	195,000	200,000
Silica sand[e]	do.	185	190	200	200	200
Stone, building stone	do.	143,359 [r]	184,174 [r]	208,343 [r]	241,379 [r]	264,176 [3]
Sulfur[e]		22,000	22,000	22,000	22,000	22,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, anthracite	thousand metric tons	27,349	34,093	38,778 [r]	42,483 [r]	39,777 [3]
Gas, natural, gross	million cubic meters	6,269 [r]	6,440 [r]	7,000 [r]	7,080 [r]	7,944 [3]
Petroleum, crude	thousand 42-gallon barrels	147,034 [r]	135,800 [r]	123,194 [r]	116,741 [r]	109,291 [3]

[e] Estimated; estimated data are rounded to no more than three significant digits. [r] Revised. do. Ditto. -- Zero.

[1] Table includes data available through February 22, 2010.

[2] In addition to the commodities listed, antimony, bentonite, refractory clay, construction aggregates, gemstones, granite, lignite, marble, rare earths, silver, and tungsten were mined but not reported. Available information is inadequate to make reliable estimates of output.

[3] Reported figure.

[4] Estimated figures based on Vietnam's inferred exports of titanium ores to China, Japan, the Republic of Korea, Malaysia, and the United States.

[5] Estimated figures based on Vietnam inferred exports of zirconium ore to China.

TABLE 1—Continued
VIETNAM: PRODUCTION OF MINERAL COMMODITIES[1]

Sources: Vietnam's General Statistics Office, Statistical Yearbook, 2007; British Geological Survey, World Mineral Statistics, 2002-06; World Metal Statistics, April 2008; South East Asia Iron and Steel Institute, Crude Steel Production, Annual Statistics, 2001-05; The Barytes Association, World Barytes Production 2001-05; International Lead and Zinc Study Group, Lead and Zinc Statistics, Monthly Bulletin of the International Lead and Zinc Study Group, February 2007; Copper Bulletin of the International Copper Study Group, May 2008; U.S. Geological Survey, Minerals Questionnaire, 2004-07.

TABLE 2
VIETNAM: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Chinfong Hai Phong Cement Corp. [Chingfong Group of Taiwan, 70%; Hai Phong Municipal Government, 15.56%; Vietnam National Cement Corp. (VNCC), 14.44%]	Min Duc near Hai Phong City	1,400
Do.		Morning Star Cement Ltd. [Holcim Group, 65%, and Vietnam National Cement Corp. (VNCC), 35%]	Hon Chong, Kien Giang Province	4,500
Do.		Nghi Son Cement Corp. [Taiheiyo Cement Corp., 45.5%; Mitsubishi Materials Corp. of Japan, 19.5%; Vietnam National Cement Corp. (VNCC), 35%]	Nghi Son, Thanh Hoa Province	2,150
Do.		Vietnam National Cement Corp. (VNCC) (100% state owned)	Bim Son, But Son, Da Nang, Ha Tien I, Ha Tien II, Hai Phong, Hai Van, Hoang Mai, Hoang Thach, and Tam Diep	18,000
Chromite, gross weight		Thai Nguyen Nonferrous Metal Co. [wholly owned subsidiary of state-owned Vietnam National Minerals Corp. (VIMICO)]	Nui Nua, Thanh Hoa Province	10
Coal, anthracite		Vietnam National Coal Corp. (VINACOAL) (100% state owned)	Cam Pha, Cao Son, Coc Sau, Vang Danh, Dong Trieu, Ha Lam, Ha Tu, Hong Gai, Khe Cham, Mao Khe, Mong Duong, Deo Nai, Cua Ong, Uong Bi in Quang Ninh Province	42,000
Copper:				
Concentrate, Cu content		Lao Cai Copper Complex [wholly owned subsidiary of Vietnam National Minerals Corp. (VIMICO)]	Sin Queyen, Lao Cai Province	11
Refined		Tang Loong Lao Cai Copper Smelting Enterprise [wholly owned subsidiary of Vietnam National Minerals Corp. (VIMICO)]	Tang Loong Long Commune, Bao Tang District, Lao Cai Province	11
Fertilizer:				
Nitrogen, ammonia		Vietnam National Chemical Corp. (VNCC) (state-owned, 100%) and Phy My Nitrogenous Fertilizer and Chemical Joint Stock Corp.	Ha Bac, northern Vietnam Phu My, Ba Ria-Vung Tau Province	375
Superphosphate		do.	Lam Thao, Phu Tho Province	800
Gas, natural	million cubic meters per day	VietSovPetro (a joint venture of Vietnam Oil and Gas Corp. and Zarubeznheft), and the joint venture of PetroVietnam, BP p.l.c., Oil and Natural Gas Co., and ConocoPhilips Co.	Offshore Bach Ho oilfield, Rang Dong oilfield, and Lan Tay/Lan Do gasfields	20
Gold, gold content of mine output	kilograms	Bong Mieu Gold Mining Company Ltd. (Bong Mieu Holdings Ltd., 80%; Mineral Development Co., 10%; Quang Nam Mineral Joint Stock Co., 10%)	Ho Gan open pit and Nui Kem underground mines	400

See footnote at end of table.

TABLE 2—Continued
VIETNAM: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron ore, gross weight		Thai Nguyen Iron and Steel Corp. [wholly owned subsidiary of Vietnam Steel Corp. (VNSTEEL)]	Trai Cau and Tein Bo in Thai Nguyen Province; Thach Khe in Ha Tinh Province	850
Petroleum, crude	thousand 42-gallon barrels per day	VietSovPetro (a joint venture of Vietnam Oil and Gas Corp. and Zarubeznheft)	Offshore Bach Ho, Rong, Rang Dong, Ruby, Bunga Kekwa, Dai Hung, and SuTu Trang oilfields	320
Phosphate rock, gross weight		Vietnam Apatite Limited Co. (Vietnam National Chemical Corp., 100%)	Cam Duong and Tang Loong, Lao Cai Province	1,250
Salt		Vietnam National Salt Corp.	Nam Dinh, Nghe An, and Hai Tin Provinces	12,000
Steel, crude		Vietnam Steel Corp. (VNSTEEL)	Cai Lan, Thai Nguyen Province, and Phu My, Ba Ria-Vung Tau Province	2,000
Tin:				
Concentrate, Sn content		Cao Bang Nonferrous Metal Co. and Nghe Tinh Nonferrous Metal Co. [wholly owned subsidiaries of state-owned Vietnam National Minerals Corp. (VIMICO)]	Pia Oac, Cao Bang Province; Quy Hop, Nghe An Province; and Tam Dao, Tuyen Quang Province	4
Refined		Thai Nguyen Nonferrous Metal Co.	Thai Nguyen, Bac Thai Province	2
Titanium, ilmenite		Bimal Minerals Co. Ltd. (Malaysia Mining Corp. and Syarikat Pendorong Sdn. Bhd., 60%, and Binh Dinh Minerals Co., 40%)	Cat Khanh, Qui Nhon, and Binh Dinh Provinces	70
Do.		Ha Tinh Minerals and Trading Co.	Cam Hoa, Ky Anhh-Cam, Xuyen, Ky Khan, and Ky Ninh, Ha Tinh Province	450
Do.		Mineral Development Co. No. 4 and No. 5 [wholly owned subsidiaries of Vietnam National Minerals Corp. (VIMICO)]	Vinh City, Nghe An Province; Tuy Hoa, Dong Xuan in Phu Yen Province; and Quang Ngan, Vinh My in Thua Thien-Hu Province	50
Zinc:				
Concentrate, Zn content		Thai Nguyen Nonferrous Metal Co. [wholly owned subsidiary of state-owned Vietnam National Minerals Corp. (VIMICO)]	Cho Dien, Bac Can Province	50
Refined		The Ta Pan Zinc-Lead Plant (a Chinese private firm, 70.2%, and Ha Giang Mineral Exploiting and Engineering Co., 29.8%)	Lung Vay, Bac Me District, Ha Giang Province	6
Do.		Thai Nguyen Zinc Refinery [wholly owned subsidiary of state-owned Vietnam National Minerals Corp. (VIMICO)]	Thai Nguyen City, Thai Nguyen Province	10

Do., do. Ditto.